nephron Clinical Practice

Nephron 2016;132(suppl1):195–236
DOI: 10.1159/000444823

Published online: April 19, 2016

UK Renal Registry 18th Annual Report: Chapter 9 Biochemical Variables amongst UK Adult Dialysis Patients in 2014: National and Centre-specific Analyses

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Key Words

Bicarbonate · Biochemical variables · Calcium · Dialysis · Haemodialysis · Parathyroid hormone · Peritoneal dialysis · Phosphate · Quality improvement

Summary

In 2014

- 57.5% of HD patients and 62.7% of PD patients achieved the audit measure for phosphate.
- 29.0% of HD and 30.3% of PD patients had a serum phosphate above the audit standard range.
- 79.1% of HD and 79.7% of PD patients had adjusted calcium between 2.2–2.5 mmol/L.
- 57.4% of HD and 65.0% of PD patients had a serum PTH between 16–72 pmol/L.
- 16.4% of HD and 12.0% of PD patients had a serum PTH >72 pmol/L.
- Simultaneous control of all three parameters within current audit standards was achieved by 50.3% of HD and 52.5% of PD patients.
- 60.4% of HD and 81.8% of PD patients achieved the audit measure for bicarbonate.

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Introduction

The UK Renal Registry (UKRR) collects routine biochemical data from clinical information systems in renal centres in England, Wales and Northern Ireland and receives data from Scotland via the Scottish Renal Registry. Annual cross sectional analyses are undertaken on some of these variables to determine centre level performance against national (Renal Association (RA)) clinical performance measures [1]. This enables UK renal centres to compare their own performance against each other and to the UK average performance. Currently the 5th edition of the UK Renal Association clinical practice guidelines is in practice [1]. This edition commenced in a graded manner in 2009 and includes an expanded number of guideline modules compared to previous editions.

Audit measures for kidney disease increasingly include tighter specification limits in conjunction with a growing evidence base. Out of range observations (e.g. hyperphosphataemia and hypophosphataemia) need to be interpreted cautiously as they may relate to different clinical problems or population characteristics. These will therefore require different strategies to improve centre performance of clinical audit measures. Summary statistical data have been provided to enhance understanding of the population characteristics of each centre and longitudinal analyses to demonstrate changes over time.

Data are also available on the UKRR data portal at www.renalreg.org.

Table 9.1 lists the recommended biochemical based audit measures from the RA which are relevant to the dialysis population. Several of the audit measures are not currently reported by the UKRR in its annual report; the reasons behind this are varied, but predominantly relate to a high proportion of incomplete data or that the relevant variable is not currently within the specified UKRR dataset. Over time it is hoped to work with the renal community to improve reporting across the range of recommended standards.

Methods

The analyses presented in this chapter relate to biochemical variables in the prevalent dialysis cohort in the UK. The cohort studied were patients prevalent on dialysis treatment on 31st December 2014. Patients receiving dialysis for less than 90 days and those who had changed modality or renal centre in the last 90 days were excluded. Haemodialysis (HD) and peritoneal dialysis (PD) cohorts were analysed separately. A full definition of the cohort including inclusion and exclusion criteria is available in appendix B (www.renalreg.org).

The biochemical variables analysed in this chapter were serum phosphate, calcium (adjusted for albumin), parathyroid hormone and bicarbonate. The method of data collection and validation by the UKRR has been previously described [2]. In brief, for each quarter of 2014 the UKRR extracted biochemical data electronically from clinical information systems in renal centres in England, Wales and Northern Ireland (E,W&NI). Scottish centres have only been included in analyses relating to corrected calcium and phosphate control, with data for their prevalent dialysis cohort being supplied directly by the Scottish Renal Registry. The UKRR does not currently collect data regarding different assay methods mainly because a single dialysis centre may process samples in several different laboratories. The audit measure used for serum phosphate was 1.1–1.7 mmol/L in both the HD and PD cohorts [1, 3]. For centres providing adjusted calcium values, these data were analysed directly as it is these values on which clinical decisions within centres are based. For centres providing unadjusted calcium values, a formula in widespread use was used to calculate adjusted calcium [4]. The audit measure for adjusted calcium depends on the local reference range [3]. For the purposes of these analyses, the UKRR has used the RA guideline standard of adjusted calcium between 2.2–2.5 mmol/L as the audit measure [3]. There are also a variety of methods and reference ranges in use to measure parathyroid hormone (PTH). To enable some form of comparative audit the UKRR has used 2–9 times the median upper limit of the reference range (8 pmol/L) as the audit measure in line with the 5th edition of the RA clinical practice guidelines and KDIGO 2009 guidance [3, 5]. This equates to a PTH range of 16–72 pmol/L. The audit measure used for serum bicarbonate in the HD cohort was 18–24 mmol/L as per the updated haemodialysis guidelines and in the PD cohort was 22–30 mmol/L. A summary of the current RA audit measures for these variables and conversion factors to SI units are given in table 9.2.

Quarterly values were extracted from the database for the last two quarters for calcium, phosphate and bicarbonate and the last three quarters for PTH. Patients who did not have these data were excluded from the analyses. Data completeness was analysed at centre and country level. All patients were included in analyses but centres with less than 50% completeness were excluded from plots and tables showing centre level performance. Data were also excluded from plots and tables when there were less than 10 patients with data, both at centre or country level. These data were analysed to calculate summary descriptive statistics (maximum, minimum, means with the corresponding standard deviation, medians and interquartile ranges). Where applicable, the percentage achieving the Renal Association standard or other surrogate clinical performance measure was also calculated.

The simultaneous control of all three components of bone and mineral disorder (BMD) parameters were analysed in combination. The proportion of patients with control of none, one, two or three parameters are presented. For the purpose of these analyses a corrected calcium between 2.2–2.5 mmol/L, a phosphate level being maintained at or below 1.7 mmol/L and a PTH level being at or below 72 pmol/L, were evaluated in combination.

Centres report several biochemical variables with different levels of accuracy, leading to problems in comparative evaluation.

Table 9.1. Summary of Renal Association audit measures for biochemical variables [1]

RA audit measure	Included in UKRR annual report	Reason
CKD-MBD in CKD stage 5D guidance		
Serum calcium, adjusted for albumin, in dialysis patients (pre-dialysis for haemodialysis patients)	Yes	
Serum phosphate in dialysis patients (pre-dialysis for haemodialysis patients)	Yes	
Proportion of PTH values within range 0/4, 1/4, 2/4, 3/4, and 4/4 of the 4 annual measurements of PTH in CKD stage 5D patients	Yes	Summary measures using data from the last three quarters for PTH-based analyses are presented, rather than stratified by quarter
Percentage of patients with all parameters (calcium/phosphate/PTH) within target range	Yes	
Peritoneal dialysis guidelines		
Cumulative frequency curves of plasma bicarbonate	Yes	Summary measures at centre and country level are presented in various formats but not as cumulative frequency curves
Haemodialysis guidelines		
Cumulative frequency curves of pre-dialysis potassium concentration	No	It is hoped for the next report that data completeness will enable analysis. There are also concerns that potential delays in blood sample processing may result in over estimates of potassium concentrations
Cumulative frequency curves of pre-dialysis serum calcium (adjusted for albumin) and phosphate concentrations	Yes	Summary measures at centre and country level are presented in various formats but not as cumulative frequency curves
Cardiovascular disease in CKD guidance		
Record of HbA1c concentrations in IFCC (mmol/mol) and/or DCCT (%) units	No	Poor data completeness
Cholesterol concentrations in patients prescribed HMG CoA reductase inhibitors	Partially	The UKRR report summary statistics for total cholesterol. These summary data were presented on 2013 data and will be presented again on 2015 data. Reliable information is not currently available within the UKRR data on statin prescription

Table 9.2. Summary of clinical audit measures and conversion factors from SI units

Biochemical variable	Clinical audit measure	Conversion factor from SI units
Phosphate	HD patients: 1.1–1.7 mmol/L PD patients: 1.1–1.7 mmol/L	mg/dl = mmol/L × 3.1
Calcium (adjusted)	Normal range (ideally <2.5 mmol/L)	mg/dl = mmol/L × 4
Parathyroid hormone	2–9 times upper limit of normal	ng/L = pmol/L × 9.5
Bicarbonate	HD patients: 18–24 mmol/L PD patients: 22–30 mmol/L	mg/dl = mmol/L × 6.1

For example, in the case of serum bicarbonate, data can be submitted as integer values but some centres submit data to one decimal place. All data has been rounded in an attempt to make all centres more comparable.

The number preceding the centre name in each figure indicates the percentage of missing data for that centre. Funnel plot analyses were used to identify outlying centres [6]. The percentage within range for each standard was plotted against centre size along with the upper and lower 95% and 99.9% limits. Centres can be identified on these plots by looking up the number of patients treated in each centre in the relevant table and finding this value on the x-axis. Longitudinal analyses were performed for some data to calculate overall changes in achievement of a performance measure annually from 2004 to 2014 and were recalculated for each previous year using the rounding procedure.

All data are presented unadjusted for case-mix.

Results

Mineral and bone variables

Phosphate

In 2014 the following Renal Association clinical practice guideline regarding phosphate management was applicable:

Guideline 3.2 CKD-MBD: Serum phosphate in dialysis patients

'We suggest that serum phosphate in dialysis patients, measured before a "short-gap" dialysis session in haemodialysis patients, should be maintained between 1.1 and 1.7 mmol/L (2C)' [3]

Overall, 21,732 HD and 3,068 PD patient details from the UK were used to perform serum phosphate analyses in 2014. The data completeness for serum phosphate across the UK was 97.2% for HD and 97.6% for PD patients, although there was considerable variation between centres (tables 9.3, 9.5).

Data completeness for serum phosphate has improved over the last decade in HD patients from 73.2% to 97.2% and in PD patients from 90.0% to 97.6%.

HD centre returns were only low (<90%) for three centres, with the most notable being Sunderland at 0%. With PD patients, five centres had data returns less than 90%. Sunderland PD patients' phosphate returns were 100% complete.

Table 9.3 Summary statistics for phosphate in haemodialysis patients in 2014

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	398	1.6	0.5	1.5	1.3	1.9
B QEH	96.9	865	1.5	0.4	1.4	1.2	1.7
Basldn	98.7	155	1.4	0.5	1.4	1.1	1.7
Bradfd	100.0	196	1.5	0.5	1.4	1.1	1.7
Brightn	99.3	395	1.6	0.5	1.5	1.3	1.9
Bristol	100.0	495	1.6	0.5	1.6	1.3	1.8
Camb	86.9	313	1.5	0.4	1.5	1.2	1.7
Carlis	100.0	60	1.6	0.5	1.5	1.3	1.9
Carsh	94.0	683	1.5	0.5	1.5	1.2	1.8
Chelms	100.0	127	1.4	0.4	1.5	1.2	1.7
Colchr	94.6	105	1.5	0.4	1.5	1.2	1.8
Covnt	99.7	329	1.6	0.5	1.6	1.3	1.9
Derby	99.6	219	1.6	0.5	1.5	1.3	1.8
Donc	100.0	166	1.6	0.5	1.5	1.2	1.8
Dorset	99.6	263	1.5	0.5	1.4	1.2	1.7
Dudley	100.0	160	1.6	0.5	1.6	1.3	1.8
Exeter	100.0	383	1.5	0.5	1.5	1.2	1.8
Glouc	100.0	204	1.5	0.5	1.5	1.2	1.7
Hull	99.7	301	1.6	0.5	1.5	1.3	1.7
Ipswi	99.1	114	1.4	0.6	1.3	1.1	1.7
Kent	100.0	374	1.7	0.5	1.6	1.3	1.9
L Barts	99.9	904	1.6	0.6	1.5	1.2	1.9
L Guys	73.7	453	1.5	0.5	1.4	1.2	1.8
L Kings	100.0	504	1.4	0.4	1.4	1.1	1.7
L Rfree	100.0	664	1.5	0.5	1.5	1.2	1.8
L St.G	100.0	284	1.5	0.5	1.4	1.2	1.7

Table 9.3 Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
L West	95.8	1,257	1.5	0.5	1.4	1.2	1.8
Leeds	100.0	471	1.6	0.5	1.5	1.2	1.9
Leic	99.9	836	1.6	0.5	1.6	1.3	1.9
Liv Ain	100.0	150	1.4	0.5	1.3	1.0	1.7
Liv Roy	99.7	342	1.5	0.5	1.4	1.2	1.8
M RI	93.9	444	1.5	0.5	1.5	1.2	1.8
Middlbr	100.0	305	1.6	0.5	1.5	1.3	1.9
Newc	100.0	266	1.5	0.5	1.5	1.2	1.8
Norwch	99.7	308	1.5	0.4	1.5	1.2	1.8
Nottm	100.0	341	1.5	0.5	1.5	1.2	1.8
Oxford	100.0	415	1.6	0.6	1.5	1.2	1.9
Plymth	100.0	129	1.6	0.5	1.5	1.2	1.9
Ports	100.0	560	1.6	0.5	1.6	1.3	1.9
Prestn	100.0	521	1.6	0.5	1.6	1.3	1.9
Redng	100.0	265	1.5	0.4	1.5	1.3	1.7
Salford	99.5	380	1.5	0.5	1.4	1.1	1.8
Sheff	100.0	555	1.6	0.5	1.5	1.2	1.8
Shrew	100.0	174	1.6	0.5	1.5	1.3	1.9
Stevng	100.0	447	1.6	0.5	1.5	1.2	1.8
Sthend	100.0	110	1.6	0.4	1.6	1.3	1.8
Stoke	97.7	301	1.5	0.4	1.4	1.2	1.8
Sund	0.0	0					
Truro	100.0	136	1.5	0.5	1.5	1.2	1.7
Wirral	98.4	186	1.6	0.5	1.5	1.2	1.9
Wolve	99.3	285	1.5	0.5	1.4	1.2	1.8
York	100.0	124	1.3	0.4	1.3	1.1	1.6
N Ireland							
Antrim	100.0	111	1.4	0.4	1.4	1.1	1.7
Belfast	100.0	189	1.5	0.6	1.4	1.1	1.8
Newry	100.0	86	1.6	0.4	1.6	1.4	1.8
Ulster	100.0	94	1.6	0.6	1.5	1.2	1.8
West NI	100.0	99	1.6	0.6	1.5	1.2	1.9
Scotland							
Abrdn	98.5	191	1.6	0.5	1.5	1.2	1.9
Airdrie	100.0	177	1.4	0.5	1.4	1.1	1.7
D & Gall	97.8	45	1.6	0.5	1.6	1.2	1.8
Dundee	98.8	163	1.7	0.5	1.6	1.3	2.0
Edinb	99.6	258	1.7	0.5	1.6	1.4	2.0
Glasgw	95.7	517	1.7	0.5	1.6	1.3	1.9
Inverns	100.0	67	1.7	0.4	1.7	1.4	1.9
Klmarnk	100.0	132	1.6	0.5	1.6	1.3	1.9
Krkcldy	99.3	139	1.5	0.4	1.5	1.3	1.8
Wales							
Bangor	100.0	78	1.5	0.5	1.4	1.3	1.7
Cardff	99.8	457	1.6	0.5	1.5	1.2	1.8
Clwyd	100.0	83	1.6	0.5	1.6	1.3	1.9
Swanse	100.0	322	1.5	0.4	1.5	1.2	1.7
Wrexm	100.0	102	1.4	0.5	1.4	1.1	1.8
England	**96.9**	**18,422**	**1.5**	**0.5**	**1.5**	**1.2**	**1.8**
N Ireland	**100.0**	**579**	**1.5**	**0.5**	**1.5**	**1.1**	**1.8**
Scotland	**98.2**	**1,689**	**1.6**	**0.5**	**1.6**	**1.3**	**1.9**
Wales	**99.9**	**1,042**	**1.5**	**0.5**	**1.5**	**1.2**	**1.8**
UK	**97.2**	**21,732**	**1.6**	**0.5**	**1.5**	**1.2**	**1.8**

Blank cells: centres excluded from analyses due to low patient numbers or poor data completeness

The individual centre means and standard deviations are shown in tables 9.3 and 9.5 for HD and PD patients respectively.

For HD 57.5% and for PD 62.7% of patients achieved a phosphate level within the target range specified by the RA clinical audit measure (tables 9.4, 9.6).

The proportion of HD patients with hyperphosphataemia was 29.0% and with hypophosphataemia was 13.5% (table 9.4).

The proportion of PD patients with hyperphosphataemia was 30.3% and with hypophosphataemia was 7.1% (table 9.6, figures 9.3, 9.4).

There was inter-centre and inter-modality variation in the proportion of patients below, within and above the phosphate range specified by the clinical performance measure (figures 9.1–9.4, tables 9.4, 9.6).

Longitudinal analysis demonstrated a small but continued improvement overall against the clinical performance measure in all the countries and modalities (figure 9.5).

Adjusted calcium

In 2014, the following Renal Association clinical practice guideline regarding calcium management was applicable:

Guideline 2.2 CKD-MBD: Serum calcium in dialysis patients (stage 5D)

'We suggest that serum calcium, adjusted for albumin concentration, should be maintained within the normal reference range for the laboratory used, measured before a "short-gap" dialysis session in haemodialysis patients. Ideally, adjusted serum calcium should be maintained between 2.2 and 2.5 mmol/L, with avoidance of hypercalcaemic episodes (2D)' [3].

Table 9.4. Percentage of haemodialysis patients within, below and above the range specified in the RA audit measure for phosphate (1.1–1.7 mmol/L) in 2014

Centre	*N*	% phos 1.1–1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.7 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
England									
B Heart	398	55.5	50.6	60.3	10.6	33.9	0.6	−6.3	7.4
B QEH	865	63.6	60.3	66.7	14.3	22.1	0.7	−3.9	5.2
Basldn	155	56.1	48.2	63.7	21.9	21.9	1.2	−10.0	12.3
Bradfd	196	55.1	48.1	61.9	20.4	24.5	1.6	−8.4	11.6
Brightn	395	58.5	53.6	63.2	10.6	30.9	−0.1	−7.1	7.0
Bristol	495	56.4	52.0	60.7	10.9	32.7	−2.2	−8.4	4.0
Camb	313	65.2	59.7	70.3	12.5	22.4	3.9	−3.5	11.3
Carlis	60	55.0	42.4	67.0	11.7	33.3	1.6	−16.4	19.5
Carsh	683	62.5	58.8	66.1	10.7	26.8	6.0	0.7	11.2
Chelms	127	64.6	55.9	72.4	18.1	17.3	−2.7	−14.8	9.4
Colchr	105	58.1	48.5	67.1	12.4	29.5	−12.2	−25.2	0.8
Covnt	329	59.9	54.5	65.0	7.6	32.5	0.0	−7.4	7.3
Derby	219	58.5	51.8	64.8	10.5	31.1	−3.2	−12.6	6.1
Donc	166	65.1	57.5	71.9	9.0	25.9	0.0	−10.6	10.6
Dorset	263	64.6	58.7	70.2	14.1	21.3	4.8	−3.6	13.2
Dudley	160	61.9	54.1	69.1	6.9	31.3	8.0	−2.8	18.9
Exeter	383	60.6	55.6	65.4	13.3	26.1	−0.1	−7.0	6.9
Glouc	204	65.2	58.4	71.4	11.8	23.0	5.2	−4.4	14.8
Hull	301	63.5	57.9	68.7	11.6	24.9	−0.7	−8.4	6.9
Ipswi	114	55.3	46.1	64.1	24.6	20.2	9.2	−3.7	22.2
Kent	374	57.5	52.4	62.4	8.6	34.0	4.5	−2.6	11.7
L Barts	904	48.2	45.0	51.5	17.2	34.6	−4.4	−9.0	0.3
L Guys	453	54.3	49.7	58.8	18.3	27.4	−0.3	−6.8	6.2
L Kings	504	66.9	62.6	70.8	16.5	16.7	1.4	−4.5	7.4
L Rfree	664	56.3	52.5	60.1	15.5	28.2	−3.1	−8.4	2.2
L St.G	284	59.5	53.7	65.1	16.6	23.9	1.4	−6.9	9.7
L West	1,257	55.1	52.3	57.8	17.0	27.9	−1.4	−5.3	2.4
Leeds	471	52.4	47.9	56.9	14.0	33.6	0.6	−5.7	7.0

Table 9.4. Continued

Centre	*N*	% phos 1.1–1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.7 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
Leic	836	56.2	52.8	59.6	8.9	34.9	2.3	−2.5	7.1
Liv Ain	150	52.0	44.0	59.9	27.3	20.7	−1.7	−13.1	9.6
Liv Roy	342	54.7	49.4	59.9	16.4	29.0	−4.7	−12.1	2.8
M RI*	444	54.3	49.6	58.9	16.4	29.3	2.4	−4.1	8.9
Middlbr	305	57.1	51.4	62.5	12.1	30.8	−0.2	−8.0	7.6
Newc	266	59.0	53.0	64.8	14.7	26.3	1.8	−6.6	10.3
Norwch	308	62.7	57.1	67.9	11.4	26.0	3.7	−4.0	11.5
Nottm	341	56.6	51.3	61.8	15.0	28.5	−0.5	−7.8	6.9
Oxford	415	49.9	45.1	54.7	15.2	34.9	−0.6	−7.5	6.2
Plymth	129	58.9	50.2	67.1	10.9	30.2	1.1	−11.2	13.3
Ports	560	50.7	46.6	54.8	13.8	35.5	0.2	−5.7	6.1
Prestn	521	53.6	49.3	57.8	10.8	35.7	−3.3	−9.4	2.7
Redng	265	67.2	61.3	72.6	11.3	21.5	4.9	−3.3	13.0
Salford*	380	50.3	45.3	55.3	20.3	29.5	−3.4	−10.8	4.1
Sheff	555	60.2	56.1	64.2	11.0	28.8	−0.5	−6.3	5.2
Shrew	174	60.3	52.9	67.3	7.5	32.2	3.2	−7.1	13.5
Stevng	447	61.1	56.5	65.5	9.8	29.1	6.6	0.0	13.1
Sthend	110	58.2	48.8	67.0	7.3	34.6	−2.7	−15.7	10.2
Stoke	301	61.8	56.2	67.1	12.6	25.6	−0.2	−8.5	8.0
Truro	136	66.9	58.6	74.3	11.8	21.3	9.4	−2.0	20.8
Wirral	186	52.2	45.0	59.2	16.7	31.2	−2.5	−12.6	7.5
Wolve	285	53.0	47.2	58.7	18.6	28.4	0.6	−7.6	8.9
York	124	62.9	54.1	70.9	23.4	13.7	0.1	−11.8	12.0
N Ireland									
Antrim	111	59.5	50.1	68.2	20.7	19.8	−1.4	−14.0	11.3
Belfast	189	48.2	41.1	55.3	24.3	27.5	−3.4	−13.4	6.6
Newry	86	57.0	46.4	67.0	11.6	31.4	−1.4	−16.2	13.5
Ulster	94	58.5	48.3	68.0	11.7	29.8	4.1	−9.7	18.0
West NI	99	55.6	45.7	65.0	8.1	36.4	−4.3	−17.7	9.2
Scotland									
Abrdn	191	58.6	51.5	65.4	10.5	30.9	3.1	−6.8	12.9
Airdrie	177	59.3	51.9	66.3	19.8	20.9	−1.6	−11.8	8.6
D & Gall	45	53.3	38.9	67.2	13.3	33.3	−3.5	−24.1	17.2
Dundee	163	52.8	45.1	60.3	6.1	41.1	2.4	−8.5	13.4
Edinb	258	53.1	47.0	59.1	6.6	40.3	1.0	−7.8	9.8
Glasgw	517	54.9	50.6	59.2	8.7	36.4	1.4	−4.6	7.4
Inverns	67	56.7	44.7	68.0	4.5	38.8	1.2	−16.6	18.9
Klmarnk	132	56.1	47.5	64.3	12.1	31.8	8.9	−3.3	21.1
Krkcldy	139	64.0	55.7	71.6	9.4	26.6	4.0	−7.5	15.5
Wales									
Bangor	78	65.4	54.2	75.1	12.8	21.8	1.1	−13.6	15.8
Cardff	457	58.0	53.4	62.4	11.6	30.4	2.5	−3.9	8.9
Clwyd	83	51.8	41.1	62.3	9.6	38.6	−3.8	−19.5	12.0
Swanse	322	65.5	60.2	70.5	11.5	23.0	2.8	−4.6	10.3
Wrexm	102	55.9	46.2	65.2	18.6	25.5	0.7	−13.2	14.5
England	**18,422**	**57.6**	**56.9**	**58.3**	**13.8**	**28.6**	**0.4**	**−0.6**	**1.4**
N Ireland	**579**	**54.6**	**50.5**	**58.6**	**16.9**	**28.5**	**−1.7**	**−7.3**	**4.0**
Scotland	**1,689**	**56.2**	**53.8**	**58.5**	**9.8**	**34.0**	**2.0**	**−1.4**	**5.3**
Wales	**1,042**	**60.2**	**57.2**	**63.1**	**12.2**	**27.6**	**1.8**	**−2.5**	**6.0**
UK	**21,732**	**57.5**	**56.9**	**58.2**	**13.5**	**29.0**	**0.6**	**−0.4**	**1.5**

*Salford and Manchester RI have been involved in the SPIRiT study —an RCT comparing low phosphate control (0.8 to 1.4 mmol/L) with high phosphate group control (1.8 to 2.4 mmol/L); HD patients only were recruited

Table 9.5. Summary statistics for phosphate in peritoneal dialysis patients in 2014

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	32	1.7	0.6	1.6	1.3	2.2
B QEH	99.2	116	1.6	0.5	1.5	1.2	1.9
Basldn	96.2	25	1.6	0.5	1.6	1.3	1.8
Bradfd	100.0	16	1.8	0.4	1.9	1.6	2.0
Brightn	100.0	55	1.6	0.4	1.6	1.4	1.8
Bristol	100.0	55	1.7	0.3	1.7	1.4	1.9
Camb	90.3	28	1.4	0.4	1.5	1.2	1.7
Carlis	100.0	24	1.6	0.3	1.6	1.4	1.7
Carsh	92.5	111	1.6	0.4	1.5	1.3	1.8
Chelms	94.7	18	1.7	0.5	1.7	1.4	1.9
Colchr	n/a						
Covnt	90.6	77	1.5	0.4	1.4	1.3	1.7
Derby	98.6	70	1.6	0.5	1.5	1.2	1.8
Donc	100.0	24	1.6	0.4	1.5	1.3	2.0
Dorset	100.0	46	1.5	0.5	1.4	1.2	1.8
Dudley	98.0	49	1.8	0.4	1.8	1.5	2.1
Exeter	100.0	83	1.5	0.4	1.5	1.3	1.7
Glouc	94.9	37	1.7	0.4	1.7	1.3	1.9
Hull	98.5	66	1.6	0.4	1.6	1.4	1.8
Ipswi	100.0	30	1.6	0.5	1.5	1.2	1.8
Kent	100.0	58	1.5	0.5	1.5	1.2	1.8
L Barts	98.0	195	1.5	0.4	1.5	1.2	1.8
L Guys	76.9	20	1.6	0.4	1.6	1.3	1.8
L Kings	100.0	79	1.5	0.4	1.5	1.2	1.7
L Rfree	98.4	123	1.6	0.5	1.6	1.3	1.9
L St.G	100.0	45	1.6	0.4	1.5	1.4	1.8
L West	84.2	48	1.5	0.4	1.4	1.2	1.8
Leeds	100.0	49	1.6	0.4	1.7	1.3	1.9
Leic	100.0	108	1.7	0.4	1.6	1.4	2.0
Liv Ain	100.0	35	1.7	0.5	1.6	1.4	1.9
Liv Roy	100.0	49	1.5	0.4	1.4	1.3	1.6
M RI	100.0	61	1.6	0.4	1.5	1.3	1.8
Middlbr	100.0	13	1.8	0.4	1.6	1.5	1.9
Newc	95.5	42	1.8	0.7	1.6	1.3	2.1
Norwch	100.0	30	1.5	0.4	1.5	1.2	1.9
Nottm	100.0	72	1.5	0.4	1.5	1.2	1.7
Oxford	100.0	76	1.6	0.4	1.5	1.4	1.8
Plymth	100.0	33	1.5	0.3	1.4	1.3	1.6
Ports	93.9	62	1.6	0.5	1.6	1.2	1.8
Prestn	100.0	46	1.6	0.4	1.5	1.4	1.7
Redng	100.0	62	1.5	0.4	1.4	1.3	1.7
Salford	94.4	68	1.8	0.5	1.6	1.5	1.9
Sheff	100.0	52	1.5	0.3	1.5	1.3	1.7
Shrew	96.2	25	1.7	0.3	1.7	1.5	1.9
Stevng	100.0	26	1.5	0.2	1.5	1.3	1.6
Sthend	100.0	16	1.7	0.4	1.7	1.4	2.0
Stoke	98.6	71	1.5	0.4	1.5	1.3	1.7
Sund	100.0	14	1.8	0.6	1.6	1.4	2.0
Truro	100.0	18	1.6	0.3	1.5	1.3	1.7
Wirral	80.0	16	1.7	0.7	1.5	1.1	2.4
Wolve	98.6	71	1.7	0.5	1.6	1.3	1.9
York	100.0	21	1.6	0.3	1.6	1.3	1.9

Table 9.5. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
N Ireland							
Antrim	100.0	13	1.6	0.4	1.5	1.3	1.8
Belfast	100.0	15	1.7	0.3	1.7	1.4	1.9
Newry	100.0	14	1.5	0.3	1.5	1.3	1.7
Ulster	100.0	4					
West NI	100.0	11	1.5	0.2	1.4	1.3	1.7
Scotland							
Abrdn	100.0	26	1.7	0.4	1.7	1.5	1.9
Airdrie	100.0	7					
D & Gall	85.7	12	1.5	0.5	1.6	1.2	1.8
Dundee	100.0	21	1.6	0.4	1.5	1.3	1.7
Edinb	89.5	17	1.6	0.4	1.6	1.4	1.7
Glasgw	97.2	35	1.7	0.4	1.5	1.4	1.9
Inverns	100.0	11	1.7	0.6	1.5	1.3	1.8
Klmarnk	100.0	35	1.7	0.4	1.6	1.4	1.9
Krkcldy	92.9	13	1.5	0.5	1.4	1.2	1.8
Wales							
Bangor	100.0	15	1.6	0.5	1.4	1.2	2.0
Cardff	98.6	71	1.5	0.4	1.4	1.3	1.8
Clwyd	90.9	10	1.6	0.4	1.5	1.3	2.1
Swanse	98.0	49	1.6	0.5	1.6	1.3	1.8
Wrexm	100.0	23	1.7	0.4	1.6	1.4	1.9
England	**97.6**	**2,666**	**1.6**	**0.4**	**1.5**	**1.3**	**1.8**
N Ireland	**100.0**	**57**	**1.6**	**0.3**	**1.5**	**1.3**	**1.8**
Scotland	**96.7**	**177**	**1.6**	**0.4**	**1.5**	**1.4**	**1.8**
Wales	**98.3**	**168**	**1.6**	**0.4**	**1.5**	**1.3**	**1.9**
UK	**97.6**	**3,068**	**1.6**	**0.4**	**1.5**	**1.3**	**1.8**

Blank cells: centres excluded from analyses due to low patient numbers or poor data completeness
n/a – no PD patients

In 2014, 21,685 HD and 3,078 PD patients' data from the UK were available for serum adjusted calcium analysis. The data were 97.0% complete for HD patients and 97.9% complete for PD patients overall, although there was between centre variation (tables 9.7, 9.9). From 2004 to 2014 across UK centres, data completeness for serum adjusted calcium increased from 57.2% to 97.0% in HD patients and from 56.8% to 97.9% in PD patients.

Coventry, Dorset, London West, Sunderland and Belfast failed to return locally adjusted calcium results and hence their data are shown using a generic formula that may not be applicable to the calcium and albumin methods used locally and may have over- or underestimated the adjusted calcium. These centres are served by laboratories that report adjusted calcium results and these should be reported to the UKRR.

Of HD patients, 79.1% (95% CI 78.6–79.7%) and of PD patients 79.7% (95% CI 78.2–81.1%) had an adjusted calcium between 2.2–2.5 mmol/L (tables 9.8, 9.10).

The proportion of hypocalcaemic patients in the UK was 10.4% for HD and 7.7% for PD (tables 9.8, 9.10). The proportion of hypercalcaemic patients in the UK was 10.5% for HD and 12.6% for PD (Tables 9.8, 9.10).

Figures 9.6 and 9.8 present the individual centre level data of achieving serum adjusted calcium levels between 2.2 and 2.5 mmol/L in HD and PD patients respectively. Figure 9.7 presents the funnel plot of HD patients attaining adjusted calcium levels between 2.2 and 2.5 mmol/L in 2014. Six centres achieved significantly lower results: Edinburgh, Middlesbrough, Birmingham Heartlands, Birmingham QEH, London Barts and London West. However, the London West data may be misleading since the centre failed to return locally adjusted calcium results. Colchester, Reading, Exeter, Stevenage and Glasgow all achieved a significantly higher percentage than the national average.

Figure 9.9 presents the funnel plots of PD patients attaining the adjusted calcium levels between 2.2 and 2.5 mmol/L in 2014. Once corrected for centre size, no centre was significantly lower than the national average. There were two centres achieving a significantly higher percentage compared with the UK average: Dorset and

Table 9.6. Percentage of peritoneal dialysis patients within, below and above the range specified in the RA audit measure for phosphate (1.1–1.7 mmol/L) in 2014

Centre	*N*	% phos 1.1–1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.7 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
England									
B Heart	32	53.1	36.1	69.4	6.3	40.6	3.1	−21.0	27.2
B QEH	116	62.9	53.8	71.2	8.6	28.5	4.8	−7.4	17.0
Basldn	25	56.0	36.6	73.7	8.0	36.0	−20.7	−45.3	4.0
Bradfd	16	37.5	17.9	62.3	6.3	56.3	−10.5	−41.3	20.3
Brightn	55	72.7	59.6	82.8	1.8	25.5	21.2	4.4	38.1
Bristol	55	54.6	41.4	67.1	0.0	45.5	0.2	−18.3	18.6
Camb	28	64.3	45.4	79.6	21.4	14.3	−2.4	−30.5	25.7
Carlis	24	75.0	54.4	88.3	4.2	20.8	9.8	−16.3	35.8
Carsh	111	61.3	51.9	69.9	10.8	27.9	−8.7	−21.5	4.0
Chelms	18	50.0	28.4	71.6	11.1	38.9	−29.0	−58.4	0.5
Covnt	77	72.7	61.8	81.5	9.1	18.2	12.1	−3.3	27.5
Derby	70	64.3	52.5	74.6	8.6	27.1	2.1	−13.6	17.9
Donc	24	62.5	42.2	79.2	8.3	29.2	−0.8	−26.8	25.1
Dorset	46	67.4	52.7	79.3	6.5	26.1	4.5	−16.4	25.5
Dudley	49	38.8	26.3	52.9	4.1	57.1	−8.0	−27.8	11.7
Exeter	83	69.9	59.2	78.8	7.2	22.9	4.8	−10.6	20.2
Glouc	37	62.2	45.8	76.2	0.0	37.8	−2.4	−25.3	20.6
Hull	66	66.7	54.5	76.9	6.1	27.3	−1.4	−17.1	14.3
Ipswi	30	66.7	48.4	81.0	6.7	26.7	−8.3	−32.5	15.9
Kent	58	56.9	44.0	68.9	12.1	31.0	−5.6	−23.6	12.4
L Barts	195	61.0	54.0	67.6	10.8	28.2	−0.1	−10.1	9.8
L Guys	20	65.0	42.6	82.3	10.0	25.0	2.5	−26.0	31.0
L Kings	79	70.9	60.0	79.8	5.1	24.1	−0.9	−15.0	13.2
L Rfree	123	56.9	48.0	65.4	8.1	35.0	−7.3	−19.9	5.2
L St.G	45	57.8	43.1	71.2	11.1	31.1	−12.7	−32.4	7.1
L West	48	62.5	48.2	74.9	10.4	27.1	−8.7	−27.1	9.8
Leeds	49	61.2	47.1	73.7	4.1	34.7	14.5	−4.0	32.9
Leic	108	53.7	44.3	62.9	4.6	41.7	−11.5	−23.9	1.0
Liv Ain	35	57.1	40.6	72.3	5.7	37.1	−12.1	−36.2	12.1
Liv Roy	49	67.4	53.2	78.9	10.2	22.5	−3.2	−21.4	14.9
M RI	61	67.2	54.6	77.8	4.9	27.9	8.1	−8.6	24.8
Middlbr	13	69.2	40.9	88.0	0.0	30.8	5.6	−32.3	43.5
Newc	42	50.0	35.3	64.7	4.8	45.2	−9.4	−32.1	13.4
Norwch	30	56.7	38.8	72.9	13.3	30.0	−16.9	−40.0	6.3
Nottm	72	68.1	56.5	77.8	9.7	22.2	−4.0	−19.2	11.2
Oxford	76	67.1	55.8	76.7	6.6	26.3	11.7	−3.3	26.7
Plymth	33	84.9	68.4	93.6	3.0	12.1	33.1	11.2	55.0
Ports	62	56.5	44.0	68.2	9.7	33.9	−2.2	−18.8	14.4
Prestn	46	73.9	59.5	84.6	2.2	23.9	14.3	−4.1	32.7
Redng	62	71.0	58.6	80.9	9.7	19.4	−1.3	−17.0	14.3
Salford	68	54.4	42.6	65.8	2.9	42.7	−1.8	−18.2	14.7
Sheff	52	80.8	67.8	89.3	3.9	15.4	18.5	2.3	34.7
Shrew	25	56.0	36.6	73.7	0.0	44.0	−13.2	−39.6	13.1
Stevng	26	84.6	65.5	94.1	7.7	7.7	26.3	5.0	47.5
Sthend	16	50.0	27.3	72.7	6.3	43.8	−10.0	−44.9	24.9
Stoke	71	67.6	55.9	77.4	9.9	22.5	10.1	−5.2	25.5
Sund	14	50.0	26.0	74.0	7.1	42.9			
Truro	18	77.8	53.5	91.4	0.0	22.2	38.9	9.3	68.5
Wirral	16	31.3	13.6	56.7	25.0	43.8	−13.8	−45.2	17.7
Wolve	71	57.8	46.1	68.6	4.2	38.0	1.3	−14.6	17.2
York	21	57.1	36.0	76.0	4.8	38.1	−14.9	−42.4	12.7

Table 9.6. Continued

Centre	*N*	% phos 1.1–1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.7 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
N Ireland									
Antrim	13	61.5	34.4	83.0	7.7	30.8	11.5	−25.7	48.8
Belfast	15	53.3	29.3	75.9	0.0	46.7	−0.5	−32.2	31.2
Newry	14	78.6	50.6	92.9	7.1	14.3	13.9	−17.4	45.1
West NI	11	90.9	56.1	98.7	0.0	9.1	26.6	−3.7	56.9
Scotland									
Abrdn	26	57.7	38.5	74.8	3.9	38.5	7.7	−21.3	36.7
D & Gall	12	50.0	24.4	75.6	8.3	41.7	−13.6	−53.7	26.5
Dundee	21	76.2	54.0	89.7	0.0	23.8	29.1	−0.8	59.0
Edinb	17	76.5	51.5	90.9	5.9	17.7	20.5	−7.6	48.5
Glasgw	35	62.9	46.0	77.1	2.9	34.3	3.9	−18.3	26.1
Inverns	11	63.6	33.9	85.7	9.1	27.3	−9.1	−47.8	29.6
Klmarnk	35	54.3	37.9	69.8	2.9	42.9	−8.9	−31.4	13.7
Krkcldy	13	38.5	17.0	65.6	23.1	38.5	−2.7	−38.0	32.6
Wales									
Bangor	15	46.7	24.1	70.7	13.3	40.0	−20.0	−56.7	16.7
Cardff	71	69.0	57.4	78.7	5.6	25.4	1.3	−14.3	17.0
Clwyd	10	60.0	29.7	84.2	10.0	30.0	−9.2	−48.6	30.2
Swanse	49	59.2	45.1	71.9	8.2	32.7	−8.7	−27.4	9.9
Wrexm	23	56.5	36.3	74.8	0.0	43.5	12.1	−18.5	42.7
England	**2,666**	**62.7**	**60.8**	**64.5**	**7.3**	**30.0**	**0.7**	**−1.9**	**3.3**
N Ireland	**57**	**68.4**	**55.4**	**79.1**	**3.5**	**28.1**	**8.4**	**−8.0**	**24.8**
Scotland	**177**	**61.6**	**54.2**	**68.5**	**5.1**	**33.3**	**4.7**	**−5.3**	**14.8**
Wales	**168**	**61.9**	**54.3**	**68.9**	**6.6**	**31.6**	**−3.3**	**−13.7**	**7.1**
UK	**3,068**	**62.7**	**61.0**	**64.4**	**7.1**	**30.3**	**0.9**	**−1.5**	**3.3**

Blank cells: no data available for 2013

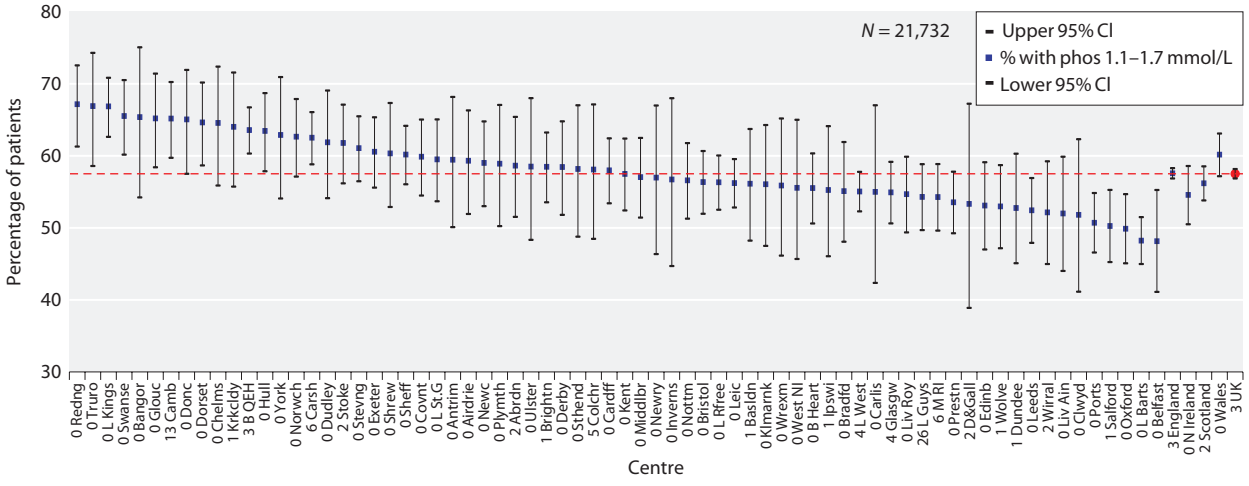

Fig. 9.1. Percentage of haemodialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.7 mmol/L) by centre in 2014

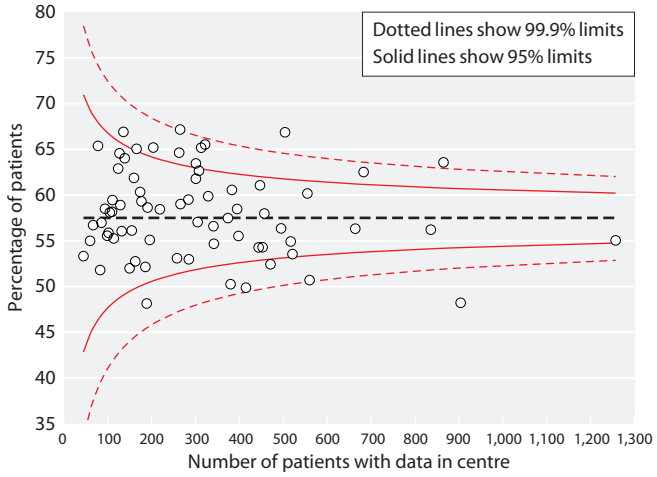

Fig. 9.2. Funnel plot of percentage of haemodialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.7 mmol/L) by centre in 2014

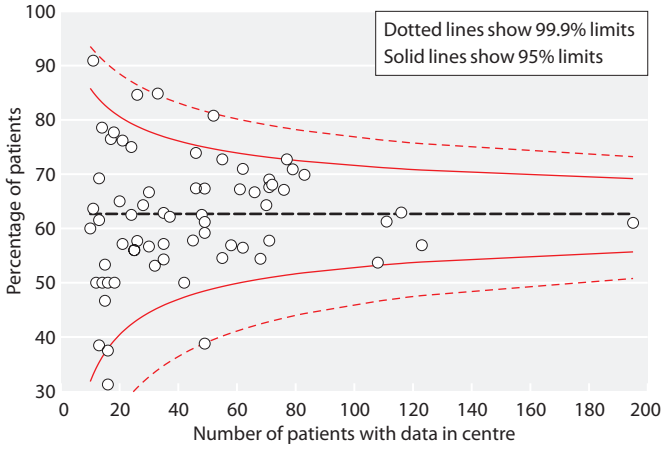

Fig. 9.4. Funnel plot of percentage of peritoneal dialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.7 mmol/L) by centre in 2014

London Guys. However, the Dorset data may be misleading since the centre failed to return locally adjusted calcium results.

Longitudinal changes in the control measures of serum adjusted calcium show improvements in the attained national standards. Hypocalcaemia in HD patients has declined since 2010, with no significant changes being observed in PD patients. In the same time period there has been little change in hypercalcaemia in either modality (figure 9.10).

Parathyroid hormone

At the beginning of 2014 the following RA guideline for PTH applied:

Guideline 4.2.1 CKD-MBD: Target range of serum PTH in patients on dialysis

'We suggest that the target range for parathyroid hormone measured using an intact PTH assay should be between 2 and 9 times the upper limit of normal for the assay used (2C)' [3].

PTH results from 19,354 HD patients and 2,714 PD patients from England, Northern Ireland and Wales were available for analysis from 2014. The data were 93.8% complete for HD patients and 91.7% for PD patients overall, although there was between centre variation (tables 9.11, 9.13).

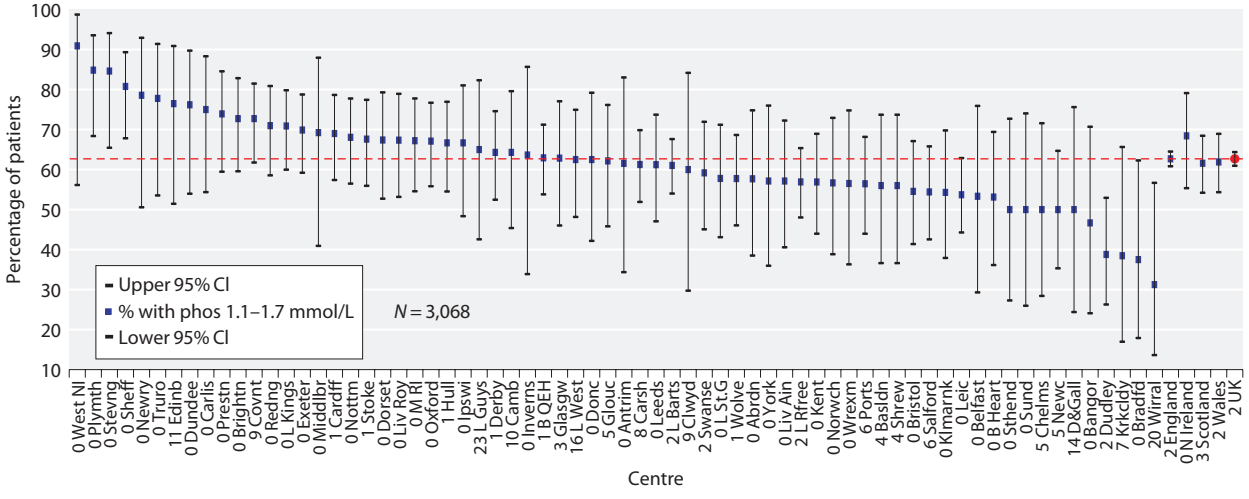

Fig. 9.3. Percentage of peritoneal dialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.7 mmol/L) by centre in 2014

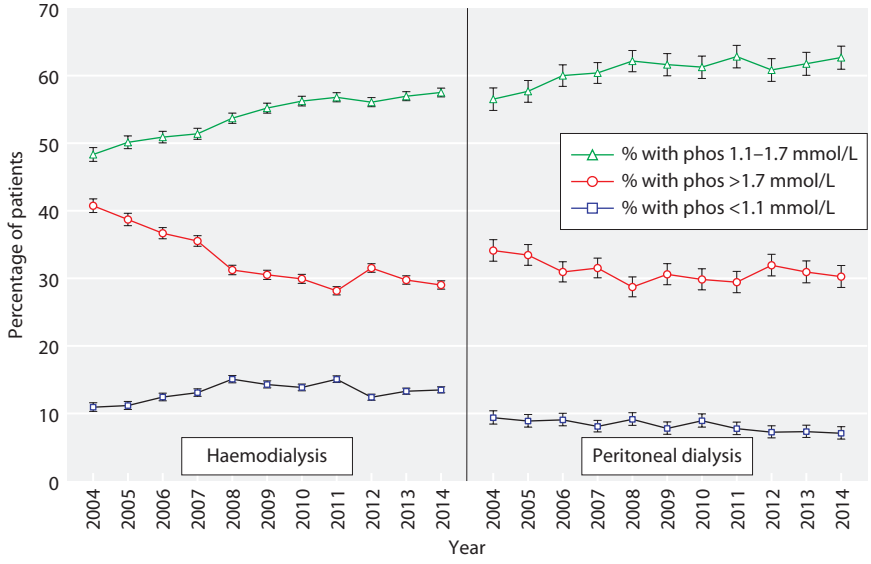

Fig. 9.5. Longitudinal change in percentage of patients with phosphate below, within and above the 2010 RA standard by dialysis modality 2004–2014

Table 9.7. Summary statistics for adjusted calcium in haemodialysis patients in 2014

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart[a]	100.0	398	2.5	0.2	2.5	2.4	2.6
B QEH	99.4	888	2.3	0.2	2.3	2.2	2.4
Basldn	99.4	156	2.4	0.1	2.4	2.3	2.5
Bradfd	100.0	196	2.4	0.2	2.4	2.3	2.5
Brightn	99.3	395	2.3	0.2	2.3	2.2	2.4
Bristol	100.0	495	2.4	0.1	2.4	2.3	2.5
Camb	86.9	313	2.3	0.2	2.3	2.2	2.5
Carlis	100.0	60	2.3	0.2	2.3	2.2	2.4
Carsh	94.2	685	2.3	0.2	2.3	2.2	2.4
Chelms	100.0	127	2.3	0.1	2.3	2.2	2.4
Colchr	94.6	105	2.4	0.1	2.4	2.3	2.5
Covnt[b]	99.7	329	2.3	0.2	2.3	2.2	2.4
Derby	99.6	219	2.5	0.2	2.5	2.4	2.6
Donc	100.0	166	2.4	0.1	2.4	2.3	2.5
Dorset[b]	99.6	263	2.3	0.2	2.3	2.2	2.4
Dudley	100.0	160	2.4	0.2	2.3	2.2	2.5
Exeter	100.0	383	2.3	0.1	2.3	2.2	2.4
Glouc	100.0	204	2.4	0.2	2.4	2.3	2.5
Hull	99.7	301	2.4	0.2	2.4	2.3	2.4
Ipswi	99.1	114	2.4	0.2	2.4	2.3	2.5
Kent	100.0	374	2.4	0.2	2.4	2.3	2.5
L Barts	99.8	903	2.3	0.2	2.3	2.2	2.4
L Guys	73.5	452	2.4	0.2	2.4	2.3	2.5
L Kings	100.0	504	2.3	0.1	2.3	2.2	2.4
L Rfree[c]	100.0	664	2.3	0.2	2.3	2.2	2.4
L St.G	100.0	284	2.3	0.2	2.3	2.2	2.4
L West[b]	76.6	1,005	2.3	0.2	2.3	2.2	2.5
Leeds	99.8	470	2.4	0.2	2.3	2.2	2.4
Leic	99.9	836	2.4	0.2	2.4	2.3	2.5

Table 9.7. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Liv Ain	100.0	150	2.4	0.2	2.3	2.3	2.5
Liv Roy	99.7	342	2.4	0.2	2.4	2.3	2.5
M RI	93.9	444	2.4	0.2	2.4	2.3	2.5
Middlbr	100.0	305	2.3	0.2	2.3	2.1	2.4
Newc[d]	100.0	266	2.3	0.2	2.3	2.2	2.4
Norwch	99.7	308	2.4	0.2	2.4	2.3	2.5
Nottm	100.0	341	2.4	0.1	2.4	2.3	2.5
Oxford	100.0	415	2.4	0.2	2.3	2.3	2.5
Plymth	98.5	127	2.3	0.2	2.3	2.2	2.4
Ports	98.8	553	2.4	0.2	2.4	2.3	2.5
Prestn	94.2	491	2.3	0.2	2.3	2.2	2.4
Redng	100.0	265	2.3	0.2	2.4	2.3	2.4
Salford	99.5	380	2.3	0.2	2.3	2.3	2.5
Sheff	100.0	555	2.3	0.2	2.3	2.2	2.4
Shrew	100.0	174	2.3	0.2	2.3	2.2	2.4
Stevng	100.0	447	2.3	0.2	2.3	2.2	2.4
Sthend	100.0	110	2.4	0.2	2.4	2.3	2.5
Stoke	97.4	300	2.4	0.2	2.4	2.3	2.5
Sund[b]	100.0	200	2.3	0.2	2.3	2.2	2.4
Truro	100.0	136	2.4	0.2	2.4	2.3	2.5
Wirral	97.9	185	2.3	0.2	2.3	2.2	2.4
Wolve	99.3	285	2.4	0.2	2.4	2.3	2.5
York	100.0	124	2.4	0.1	2.4	2.3	2.5
N Ireland							
Antrim	100.0	111	2.4	0.2	2.4	2.2	2.5
Belfast[b]	100.0	189	2.4	0.2	2.4	2.3	2.5
Newry	100.0	86	2.3	0.2	2.3	2.2	2.4
Ulster	97.9	92	2.4	0.2	2.4	2.3	2.5
West NI	100.0	99	2.3	0.2	2.3	2.2	2.4
Scotland							
Abrdn	98.5	191	2.3	0.2	2.3	2.2	2.4
Airdrie	100.0	177	2.4	0.2	2.3	2.3	2.4
D & Gall	97.8	45	2.3	0.2	2.3	2.2	2.4
Dundee	99.4	164	2.4	0.2	2.4	2.3	2.5
Edinb	99.6	258	2.4	0.2	2.4	2.3	2.5
Glasgw	100.0	540	2.4	0.1	2.4	2.3	2.4
Inverns	100.0	67	2.4	0.2	2.4	2.3	2.5
Klmarnk	100.0	132	2.4	0.2	2.3	2.2	2.5
Krkcldy	100.0	140	2.3	0.2	2.3	2.3	2.4
Wales							
Bangor	100.0	78	2.3	0.2	2.3	2.3	2.4
Cardff	99.8	457	2.4	0.2	2.3	2.2	2.5
Clwyd	100.0	83	2.3	0.2	2.3	2.2	2.5
Swanse	100.0	322	2.3	0.2	2.3	2.2	2.4
Wrexm	100.0	102	2.4	0.2	2.4	2.3	2.5
England	**96.5**	**18,352**	**2.4**	**0.2**	**2.3**	**2.2**	**2.5**
N Ireland	**99.7**	**577**	**2.4**	**0.2**	**2.3**	**2.2**	**2.5**
Scotland	**99.7**	**1,714**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
Wales	**99.9**	**1,042**	**2.3**	**0.2**	**2.3**	**2.2**	**2.4**
UK	**97.0**	**21,685**	**2.4**	**0.2**	**2.3**	**2.2**	**2.5**

[a]Birmingham Heartlands had a change in calcium assay in 2012
[b]These centres supplied unadjusted calcium and were corrected using the formula: adjusted calcium = unadjusted calcium + [(40-albumin) × 0.02]
[c]London Royal Free were using an incorrect equation to adjust for calcium until October 2013 when this was rectified
[d]Newcastle were using an incorrect equation to adjust for calcium until April 2013 when this was rectified

Table 9.8. Percentage of haemodialysis patients within, below and above the range for adjusted calcium (2.2–2.5 mmol/L) in 2014

Centre	*N*	% adjusted Ca 2.2–2.5 mmol/L	Lower 95% CI	Upper 95% CI	% adjusted Ca <2.2 mmol/L	% adjusted Ca >2.5 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
England									
B Heart[a]	398	68.3	63.6	72.7	2.8	28.9	3.2	−3.4	9.7
B QEH	888	74.2	71.2	77.0	23.2	2.6	−2.9	−6.9	1.1
Basldn	156	80.8	73.8	86.2	2.6	16.7	−3.3	−11.8	5.2
Bradfd	196	81.1	75.0	86.0	4.6	14.3	0.0	−7.8	7.9
Brightn	395	83.3	79.3	86.7	9.4	7.3	12.5	6.1	18.9
Bristol	495	84.4	81.0	87.4	1.6	13.9	−2.0	−6.4	2.5
Camb	313	73.2	68.0	77.8	16.0	10.9	−9.0	−15.4	−2.7
Carlis	60	80.0	68.0	88.3	15.0	5.0	14.5	−1.4	30.4
Carsh	685	77.2	73.9	80.2	15.6	7.2	−3.8	−8.1	0.5
Chelms	127	85.0	77.7	90.3	11.8	3.2	−3.1	−11.8	5.5
Colchr	105	93.3	86.7	96.8	0.0	6.7	0.3	−6.6	7.1
Covnt[b]	329	78.7	74.0	82.8	11.6	9.7	3.0	−3.3	9.3
Derby	219	72.2	65.8	77.7	1.8	26.0	−2.1	−10.6	6.4
Donc	166	86.8	80.7	91.1	6.0	7.2	−4.3	−11.3	2.6
Dorset[b]	263	81.8	76.6	86.0	13.7	4.6	−0.6	−7.3	6.1
Dudley	160	79.4	72.4	85.0	11.9	8.8	−1.4	−10.2	7.4
Exeter	383	88.8	85.2	91.6	2.6	8.6	0.5	−4.1	5.0
Glouc	204	83.8	78.1	88.3	7.4	8.8	1.7	−5.7	9.1
Hull	301	84.7	80.2	88.4	4.7	10.6	5.1	−1.0	11.2
Ipswi	114	82.5	74.4	88.4	2.6	14.9	6.3	−4.2	16.9
Kent	374	77.0	72.5	81.0	6.7	16.3	6.4	0.1	12.8
L Barts	903	73.1	70.1	75.9	16.7	10.2	2.2	−2.0	6.3
L Guys	452	81.6	77.8	84.9	5.8	12.6	5.2	−0.1	10.5
L Kings	504	82.5	79.0	85.6	14.9	2.6	−5.9	−10.3	−1.5
L Rfree[c]	664	79.1	75.8	82.0	13.3	7.7	−6.8	−10.9	−2.7
L St.G	284	82.4	77.5	86.4	9.5	8.1	3.2	−3.5	9.8
L West[b]	1,005	71.5	68.7	74.3	15.6	12.8	3.7	−0.1	7.5
Leeds	470	79.4	75.5	82.8	8.1	12.6	−1.7	−6.8	3.3
Leic	836	79.7	76.8	82.3	7.3	13.0	1.4	−2.5	5.3
Liv Ain	150	80.0	72.8	85.7	6.0	14.0	−2.3	−11.2	6.6
Liv Roy	342	80.7	76.2	84.5	7.0	12.3	3.0	−3.1	9.1
M RI	444	76.6	72.4	80.3	10.6	12.8	−1.4	−6.9	4.0
Middlbr	305	67.5	62.1	72.6	28.5	3.9	−0.8	−8.2	6.5
Newc[d]	266	79.7	74.4	84.1	14.3	6.0	−8.2	−14.5	−2.0
Norwch	308	79.2	74.3	83.4	2.9	17.9	6.6	−0.2	13.3
Nottm	341	85.3	81.2	88.7	5.0	9.7	7.4	1.6	13.1
Oxford	415	79.8	75.6	83.4	10.1	10.1	−0.7	−6.2	4.8
Plymth	127	80.3	72.5	86.3	11.0	8.7	2.8	−7.4	13.0
Ports	553	80.1	76.6	83.2	8.1	11.8	1.6	−3.2	6.4
Prestn	491	79.2	75.4	82.6	16.3	4.5	0.4	−4.7	5.5
Redng	265	88.3	83.8	91.7	7.9	3.8	4.1	−1.8	10.0
Salford	380	80.5	76.2	84.2	10.3	9.2	0.4	−5.5	6.3
Sheff	555	80.5	77.0	83.6	11.4	8.1	0.7	−4.0	5.4
Shrew	174	81.0	74.5	86.2	10.3	8.6	−1.3	−9.4	6.9
Stevng	447	85.9	82.4	88.8	7.4	6.7	4.2	−0.7	9.1
Sthend	110	77.3	68.5	84.2	8.2	14.6	5.5	−6.0	16.9
Stoke	300	81.0	76.2	85.1	8.3	10.7	−2.6	−9.2	3.9
Sund[b]	200	74.5	68.0	80.1	16.5	9.0	−0.2	−9.0	8.6
Truro	136	78.7	71.0	84.8	7.4	14.0	−2.6	−12.1	6.8
Wirral	185	78.4	71.9	83.7	12.4	9.2	−5.0	−12.9	3.0
Wolve	285	74.0	68.6	78.8	3.5	22.5	−3.2	−10.3	3.9
York	124	82.3	74.5	88.0	1.6	16.1	−10.0	−18.1	−1.8

Table 9.8. Continued

Centre	*N*	% adjusted Ca 2.2–2.5 mmol/L	Lower 95% CI	Upper 95% CI	% adjusted Ca <2.2 mmol/L	% adjusted Ca >2.5 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
N Ireland									
Antrim	111	78.4	69.8	85.1	9.0	12.6	9.2	−2.1	20.5
Belfast[b]	189	80.4	74.2	85.5	6.4	13.2	3.8	−4.4	11.9
Newry	86	75.6	65.4	83.5	17.4	7.0	−8.6	−20.6	3.5
Ulster	92	73.9	64.0	81.9	3.3	22.8	−8.6	−20.2	3.0
West NI	99	79.8	70.8	86.6	12.1	8.1	−1.5	−12.3	9.3
Scotland									
Abrdn	191	81.7	75.6	86.5	11.0	7.3			
Airdrie	177	85.9	79.9	90.3	6.2	7.9			
D & Gall	45	82.2	68.3	90.9	11.1	6.7			
Dundee	164	82.9	76.4	87.9	6.7	10.4			
Edinb	258	68.6	62.7	74.0	6.6	24.8			
Glasgw	540	88.7	85.8	91.1	4.4	6.9			
Inverns	67	74.6	62.9	83.6	7.5	17.9			
Klmarnk	132	77.3	69.4	83.6	10.6	12.1			
Krkcldy	140	81.4	74.1	87.0	9.3	9.3			
Wales									
Bangor	78	85.9	76.3	92.0	9.0	5.1	0.2	−10.6	10.9
Cardff	457	78.1	74.1	81.7	11.4	10.5	7.2	1.6	12.8
Clwyd	83	73.5	63.0	81.9	13.3	13.3	−9.8	−22.7	3.0
Swanse	322	77.0	72.1	81.3	15.2	7.8	4.7	−2.1	11.4
Wrexm	102	77.5	68.3	84.5	4.9	17.7	2.5	−9.4	14.3
England	**18,352**	**79.0**	**78.4**	**79.6**	**10.6**	**10.4**	**0.5**	**−0.3**	**1.3**
N Ireland	**577**	**78.2**	**74.6**	**81.4**	**9.0**	**12.8**	**0.2**	**−4.6**	**4.9**
Scotland	**1,714**	**81.9**	**80.0**	**83.6**	**7.1**	**11.1**			
Wales	**1,042**	**77.9**	**75.3**	**80.3**	**11.9**	**10.2**	**4.1**	**0.4**	**7.8**
UK	**21,685**	**79.1**	**78.6**	**79.7**	**10.4**	**10.5**	**0.9**	**0.1**	**1.7**

Blank cells: no data available for 2013
[a]Birmingham Heartlands had a change in calcium assay in 2012
[b]These centres supplied unadjusted calcium and were corrected using the formula: adjusted calcium = unadjusted calcium + [(40-albumin) × 0.02]
[c]London Royal Free were using an incorrect equation to adjust for calcium until October 2013 when this was rectified
[d]Newcastle were using an incorrect equation to adjust for calcium until April 2013 when this was rectified

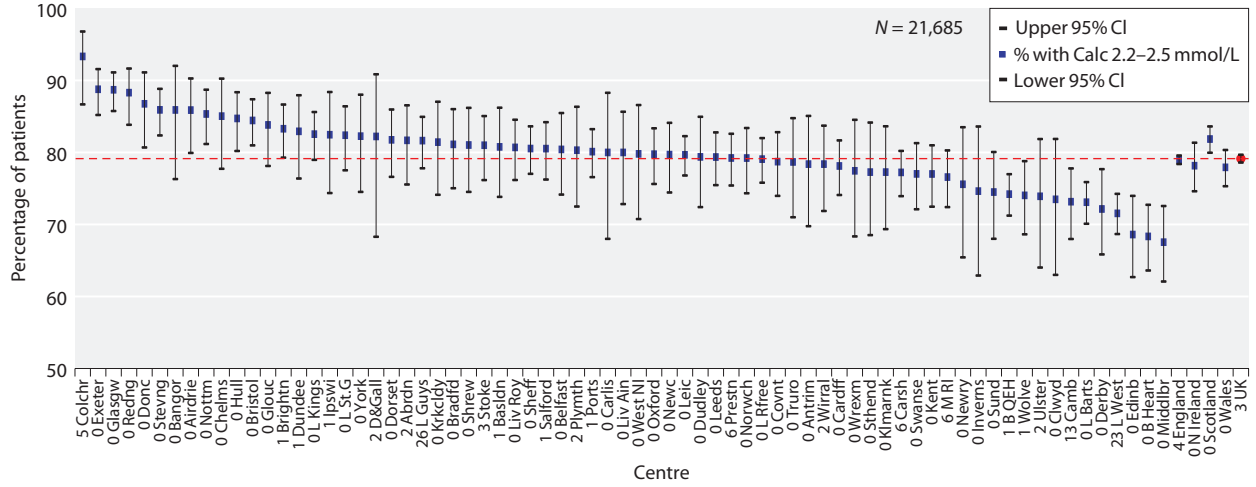

Fig. 9.6. Percentage of haemodialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2014

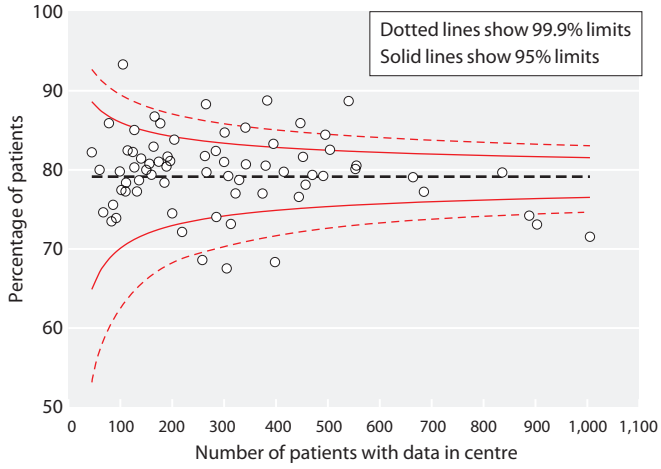

Fig. 9.7. Funnel plot of percentage of haemodialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2014

From 2004 to 2014 across the three countries, data completeness for PTH increased from 76.6% to 93.8% in HD patients and from 80.1% to 91.7% in PD patients.

Median PTH among HD patients was 30 pmol/L (IQR 15–55 pmol/l) and among PD patients was 30 pmol/L (IQR 17–51 pmol/L) for the three countries.

Of HD patients, 57.4% (95% CI 56.7–58.1%) and of PD patients, 65.0% (95% CI 63.1–66.7%) achieved a PTH between 16–72 pmol/L (tables 9.12, 9.14, figures 9.11–9.14).

In 2014, the proportion of HD patients with a PTH above the upper limit of the range (>72 pmol/L) was 16.4% and the proportion below the lower limit of the range (<16 pmol/L) was 26.2%.

The proportion of PD patients with PTH above the upper limit (>72 pmol/L) of the range was 12.0% and

Table 9.9. Summary statistics for adjusted calcium in peritoneal dialysis patients in 2014

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart[a]	100.0	32	2.5	0.1	2.5	2.4	2.5
B QEH	100.0	117	2.4	0.2	2.3	2.2	2.4
Basldn	96.2	25	2.5	0.2	2.5	2.4	2.5
Bradfd	93.8	15	2.4	0.2	2.4	2.3	2.5
Brightn	100.0	55	2.4	0.1	2.4	2.3	2.5
Bristol	100.0	55	2.5	0.2	2.5	2.4	2.5
Camb	90.3	28	2.3	0.2	2.4	2.2	2.4
Carlis	100.0	24	2.2	0.2	2.3	2.2	2.3
Carsh	92.5	111	2.3	0.2	2.3	2.2	2.4
Chelms	100.0	19	2.5	0.1	2.5	2.3	2.5
Colchr[b]							
Covnt[c]	95.3	81	2.3	0.2	2.3	2.2	2.4
Derby	100.0	71	2.5	0.2	2.5	2.4	2.6
Donc	100.0	24	2.4	0.2	2.4	2.3	2.5
Dorset[c]	100.0	46	2.3	0.1	2.3	2.2	2.4
Dudley	98.0	49	2.5	0.2	2.4	2.4	2.5
Exeter	100.0	83	2.4	0.1	2.4	2.3	2.5
Glouc	94.9	37	2.4	0.2	2.4	2.3	2.4
Hull	98.5	66	2.4	0.2	2.4	2.3	2.5
Ipswi	100.0	30	2.3	0.2	2.4	2.2	2.4
Kent	100.0	58	2.4	0.2	2.5	2.3	2.6
L Barts	98.0	195	2.3	0.2	2.3	2.2	2.4
L Guys	76.9	20	2.4	0.1	2.3	2.3	2.4
L Kings	100.0	79	2.3	0.1	2.2	2.2	2.3
L Rfree[d]	98.4	123	2.3	0.2	2.3	2.3	2.4
L St.G	100.0	45	2.4	0.1	2.4	2.3	2.5
L West[c]	84.2	48	2.5	0.2	2.5	2.4	2.7
Leeds	100.0	49	2.4	0.1	2.3	2.3	2.5
Leic	100.0	108	2.4	0.2	2.4	2.3	2.5
Liv Ain	100.0	35	2.3	0.2	2.3	2.2	2.4
Liv Roy	100.0	49	2.4	0.2	2.4	2.3	2.4

Table 9.9. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
M RI	100.0	61	2.4	0.2	2.4	2.3	2.5
Middlbr	100.0	13	2.3	0.2	2.3	2.2	2.4
Newc[e]	95.5	42	2.3	0.2	2.3	2.2	2.4
Norwch	100.0	30	2.5	0.2	2.5	2.4	2.6
Nottm	98.6	71	2.4	0.2	2.4	2.3	2.5
Oxford	100.0	76	2.4	0.2	2.4	2.3	2.5
Plymth	100.0	33	2.4	0.1	2.3	2.3	2.5
Ports	93.9	62	2.4	0.2	2.4	2.3	2.4
Prestn	100.0	46	2.3	0.2	2.3	2.2	2.4
Redng	100.0	62	2.4	0.1	2.4	2.3	2.5
Salford	94.4	68	2.4	0.2	2.4	2.3	2.5
Sheff	100.0	52	2.4	0.2	2.3	2.3	2.5
Shrew	96.2	25	2.4	0.1	2.4	2.3	2.4
Stevng	100.0	26	2.3	0.1	2.3	2.3	2.4
Sthend	100.0	16	2.4	0.2	2.4	2.3	2.5
Stoke	98.6	71	2.4	0.2	2.4	2.3	2.5
Sund[c]	100.0	14	2.3	0.2	2.4	2.2	2.4
Truro	100.0	18	2.4	0.2	2.4	2.3	2.5
Wirral	80.0	16	2.3	0.1	2.3	2.2	2.4
Wolve	98.6	71	2.4	0.2	2.4	2.3	2.5
York	100.0	21	2.4	0.1	2.4	2.3	2.4
N Ireland							
Antrim	100.0	13	2.4	0.1	2.4	2.4	2.5
Belfast[c]	100.0	15	2.3	0.2	2.3	2.3	2.5
Newry	100.0	14	2.4	0.2	2.4	2.3	2.5
Ulster	100.0	4					
West NI	100.0	11	2.3	0.1	2.3	2.2	2.4
Scotland							
Abrdn	100.0	26	2.3	0.2	2.3	2.2	2.3
Airdrie	100.0	7					
D & Gall	100.0	14	2.4	0.2	2.3	2.3	2.5
Dundee	100.0	21	2.4	0.2	2.3	2.3	2.5
Edinb	100.0	19	2.5	0.2	2.5	2.4	2.6
Glasgw	100.0	36	2.3	0.2	2.3	2.2	2.5
Inverns	100.0	11	2.4	0.1	2.4	2.2	2.5
Klmarnk	100.0	35	2.4	0.2	2.4	2.2	2.5
Krkcldy	92.9	13	2.4	0.2	2.4	2.3	2.4
Wales							
Bangor	100.0	15	2.4	0.2	2.4	2.2	2.5
Cardff	98.6	71	2.4	0.2	2.4	2.3	2.5
Clwyd	90.9	10	2.4	0.2	2.5	2.4	2.5
Swanse	98.0	49	2.3	0.1	2.3	2.3	2.4
Wrexm	100.0	23	2.4	0.1	2.4	2.3	2.5
England	**97.8**	**2,671**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
N Ireland	**100.0**	**57**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
Scotland	**99.5**	**182**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
Wales	**98.3**	**168**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
UK	**97.9**	**3,078**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**

Blank cells: centres excluded from the analysis due to low patient numbers
[a]Birmingham Heartlands had a change in calcium assay in 2012
[b]No PD patients
[c]These centres supplied unadjusted calcium and were corrected using the formula: adjusted calcium = unadjusted calcium + [(40-albumin) × 0.02]
[d]London Royal Free were using an incorrect equation to adjust for calcium until October 2013 when this was rectified
[e]Newcastle were using an incorrect equation to adjust for calcium until April 2013 when this was rectified

Table 9.10. Percentage of peritoneal dialysis patients within, below and above the range for adjusted calcium (2.2–2.5 mmol/L) in 2014

Centre	*N*	% adjusted Ca 2.2–2.5 mmol/L	Lower 95% CI	Upper 95% CI	% adjusted Ca <2.2 mmol/L	% adjusted Ca >2.5 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
England									
B Heart[a]	32	84.4	67.5	93.3	0.0	15.6	−3.9	−20.5	12.7
B QEH	117	82.9	75.0	88.7	7.7	9.4	5.4	−4.5	15.3
Basldn	25	80.0	60.0	91.4	0.0	20.0	3.3	−18.5	25.1
Bradfd	15	86.7	59.5	96.6	6.7	6.7	10.7	−13.3	34.7
Brightn	55	83.6	71.4	91.3	1.8	14.6	−2.7	−15.5	10.1
Bristol	55	74.6	61.5	84.3	1.8	23.6	−9.7	−24.6	5.2
Camb	28	82.1	63.6	92.4	14.3	3.6	9.9	−15.2	35.0
Carlis	24	75.0	54.4	88.3	25.0	0.0	−7.6	−30.8	15.6
Carsh	111	80.2	71.7	86.6	17.1	2.7	1.2	−9.7	12.1
Chelms	19	89.5	66.3	97.4	0.0	10.5	−10.5	−24.3	3.3
Covnt[b]	81	77.8	67.5	85.5	17.3	4.9	−9.5	−21.5	2.4
Derby	71	67.6	55.9	77.4	2.8	29.6	−1.7	−16.8	13.4
Donc	24	83.3	63.1	93.6	4.2	12.5	−3.3	−22.6	15.9
Dorset[b]	46	93.5	81.6	97.9	2.2	4.4	1.8	−9.7	13.3
Dudley	49	75.5	61.7	85.5	2.0	22.5	−7.5	−23.6	8.7
Exeter	83	90.4	81.9	95.1	0.0	9.6	1.5	−8.6	11.5
Glouc	37	83.8	68.3	92.5	8.1	8.1	−3.3	−20.1	13.4
Hull	66	77.3	65.7	85.8	9.1	13.6	−0.5	−14.5	13.4
Ipswi	30	73.3	55.0	86.1	10.0	16.7	6.7	−18.0	31.3
Kent	58	67.2	54.3	78.0	5.2	27.6	8.3	−9.4	26.0
L Barts	195	75.9	69.4	81.4	14.9	9.2	5.6	−3.4	14.7
L Guys	20	100.0	0.0	100.0	0.0	0.0	20.8	4.6	37.1
L Kings	79	77.2	66.7	85.2	21.5	1.3	−8.7	−20.7	3.4
L Rfree[c]	123	81.3	73.4	87.3	13.8	4.9	−3.1	−12.8	6.6
L St.G	45	86.7	73.4	93.9	2.2	11.1	11.1	−4.9	27.1
L West[b]	48	56.3	42.1	69.5	2.1	41.7	10.1	−9.4	29.6
Leeds	49	91.8	80.2	96.9	2.0	6.1	16.0	2.9	29.2
Leic	108	82.4	74.1	88.5	4.6	13.0	1.3	−8.5	11.2
Liv Ain	35	71.4	54.6	83.9	14.3	14.3	−9.3	−30.6	12.0
Liv Roy	49	81.6	68.3	90.2	4.1	14.3	−4.6	−19.0	9.7
M RI	61	77.1	64.9	85.9	6.6	16.4	2.8	−12.1	17.7
Middlbr	13	69.2	40.9	88.0	23.1	7.7	−21.7	−52.0	8.6
Newc[d]	42	78.6	63.7	88.5	14.3	7.1	6.7	−13.2	26.6
Norwch	30	60.0	42.0	75.7	6.7	33.3	−1.8	−25.7	22.2
Nottm	71	73.2	61.8	82.2	7.0	19.7	−7.6	−21.5	6.3
Oxford	76	84.2	74.2	90.8	2.6	13.2	9.5	−2.9	21.9
Plymth	33	90.9	75.3	97.0	6.1	3.0	18.5	−0.5	37.5
Ports	62	85.5	74.4	92.3	4.8	9.7	0.2	−11.7	12.0
Prestn	46	76.1	61.8	86.2	15.2	8.7	1.1	−16.0	18.1
Redng	62	87.1	76.3	93.4	1.6	11.3	−0.6	−12.1	11.0
Salford	68	80.9	69.8	88.6	4.4	14.7	4.2	−9.3	17.6
Sheff	52	88.5	76.6	94.7	3.9	7.7	6.5	−6.5	19.5
Shrew	25	92.0	73.1	98.0	4.0	4.0	22.8	2.1	43.5
Stevng	26	88.5	69.7	96.2	11.5	0.0	2.0	−14.5	18.5
Sthend	16	75.0	49.2	90.3	0.0	25.0	−5.0	−34.3	24.3
Stoke	71	77.5	66.3	85.7	4.2	18.3	8.4	−6.0	22.9
Sund[b]	14	64.3	37.6	84.3	21.4	14.3			
Truro	18	77.8	53.5	91.4	0.0	22.2	0.0	−27.2	27.2
Wirral	16	87.5	61.4	96.9	6.3	6.3	7.5	−16.4	31.4
Wolve	71	74.7	63.3	83.4	7.0	18.3	−10.0	−22.9	2.9
York	21	90.5	68.9	97.6	0.0	9.5	6.5	−12.6	25.6

Table 9.10. Continued

Centre	*N*	% adjusted Ca 2.2–2.5 mmol/L	Lower 95% CI	Upper 95% CI	% adjusted Ca <2.2 mmol/L	% adjusted Ca >2.5 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
N Ireland									
Antrim	13	76.9	47.9	92.4	0.0	23.1	15.4	−19.6	50.4
Belfast[b]	15	73.3	46.7	89.6	13.3	13.3	−11.3	−37.6	15.0
Newry	14	71.4	44.0	88.9	7.1	21.4	−22.7	−48.9	3.5
West NI	11	90.9	56.1	98.7	0.0	9.1	12.3	−15.1	39.7
Scotland									
Abrdn	26	69.2	49.5	83.8	23.1	7.7			
D & Gall	14	78.6	50.6	92.9	7.1	14.3			
Dundee	21	76.2	54.0	89.7	4.8	19.1			
Edinb	19	73.7	50.2	88.6	0.0	26.3			
Glasgw	36	83.3	67.5	92.3	5.6	11.1			
Inverns	11	90.9	56.1	98.7	0.0	9.1			
Klmarnk	35	68.6	51.7	81.7	14.3	17.1			
Krkcldy	13	92.3	60.9	98.9	0.0	7.7			
Wales									
Bangor	15	73.3	46.7	89.6	13.3	13.3	−10.0	−40.8	20.8
Cardff	71	78.9	67.9	86.8	5.6	15.5	23.5	8.1	38.9
Clwyd	10	80.0	45.9	95.0	0.0	20.0	3.1	−30.7	36.8
Swanse	49	85.7	72.9	93.0	6.1	8.2	0.8	−12.9	14.5
Wrexm	23	91.3	71.1	97.8	0.0	8.7	19.1	−4.6	42.8
England	**2,671**	**79.8**	**78.3**	**81.3**	**7.8**	**12.4**	**1.3**	**−0.9**	**3.5**
N Ireland	**57**	**75.4**	**62.7**	**84.9**	**7.0**	**17.5**	**−4.3**	**−18.7**	**10.2**
Scotland	**182**	**76.9**	**70.3**	**82.5**	**8.2**	**14.8**			
Wales	**168**	**82.1**	**75.6**	**87.2**	**5.4**	**12.5**	**11.3**	**2.2**	**20.4**
UK	**3,078**	**79.7**	**78.2**	**81.1**	**7.7**	**12.6**	**1.6**	**−0.5**	**3.6**

[a]Birmingham Heartlands had a change in calcium assay in 2012
[b]These centres supplied unadjusted calcium and were corrected using the formula: adjusted calcium = unadjusted calcium + [(40-albumin) × 0.02]
[c]London Royal Free were using an incorrect equation to adjust for calcium until October 2013 when this was rectified
[d]Newcastle were using an incorrect equation to adjust for calcium until April 2013 when this was rectified

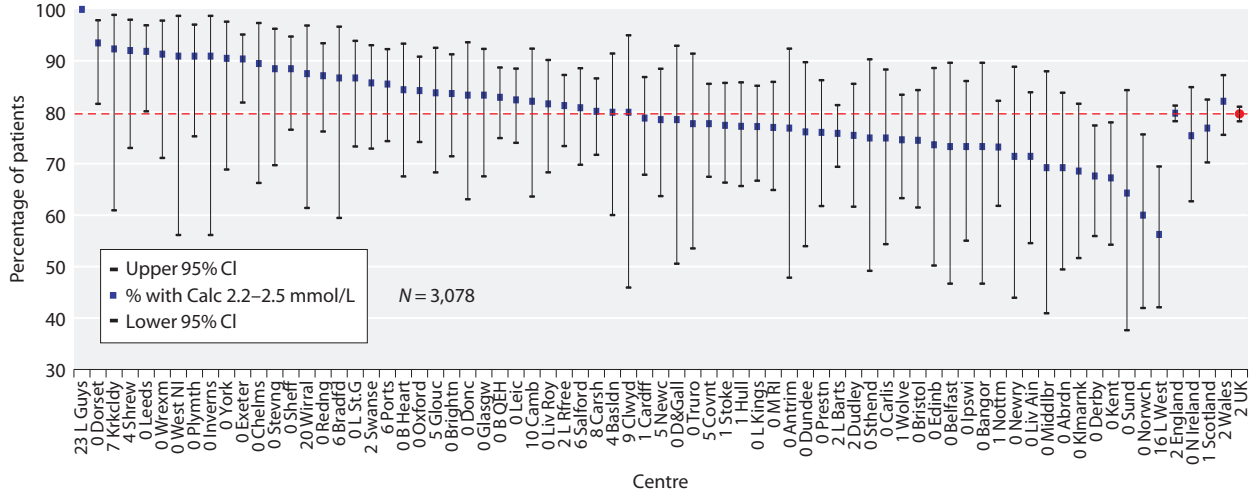

Fig. 9.8. Percentage of peritoneal dialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2014

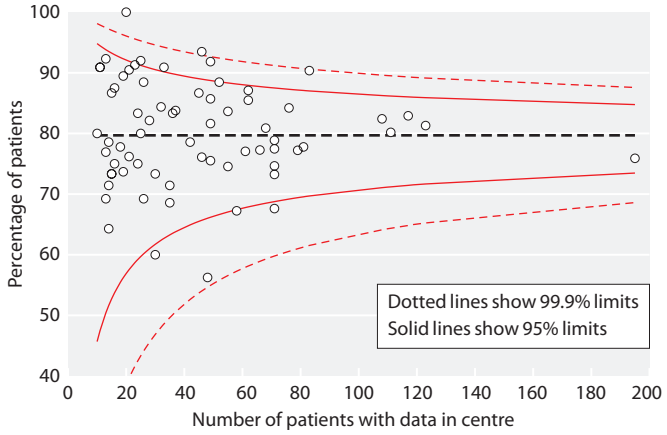

Fig. 9.9. Funnel plot of percentage of peritoneal dialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2014

the proportion below the lower limit of the range (<16 pmol/L) was 23.1% (tables 9.12, 9.14).

There was significant variation by centre following unadjusted analyses for the proportion of patients below, within and above the range specified by the clinical performance measures. The funnel plot (figure 9.12) for HD patients showed above average achievement of the target range in Antrim, Doncaster, Derby, Kent, Stevenage and London Barts and below average achievement for Liverpool Aintree, Exeter, Leicester and London West. For PD patients (figure 9.14) there were no outliers.

Longitudinal analysis of PTH control measures at the level of the three countries noted sustained reduction in the proportion of patients with low PTH levels (<16 pmol/L) in HD and PD patients. Similarly, there has been a corresponding increase in the fraction of HD and PD patients with PTH levels being maintained within the 16–72 pmol/L range. The fraction of patients with PTH above range (>72 pmol/L) increased from 13.9% in 2004 to 16.4%in 2014 in HD and decreased from 13.3% to 12.0% in PD (figure 9.15).

Simultaneous control of adjusted calcium, phosphate and PTH in preventing severe hyperparathyroidism

Biochemical results to perform the bone mineral disease (BMD) combination analyses were available from 61 HD and 58 PD centres, covering 18,896 HD and 2,676 PD patients, from England, Wales and Northern Ireland in 2014.

Tables 9.15 and 9.16 identify each centre and detail the numbers of patients who had received HD and PD and the results of the BMD combination analyses.

Figures 9.16 and 9.17 demonstrate the caterpillar plots of all centres and the percentage achievement of simultaneous control of all three BMD parameters for HD and PD patients respectively.

Control of none of the parameters of BMD was found in 1.8% of HD and 1.8% of PD patients across England, Wales and Northern Ireland. Control of one parameter was reported in 12.7% of HD and 10.8% of PD patients; of two parameters in 35.2% of HD and 35.0% of PD

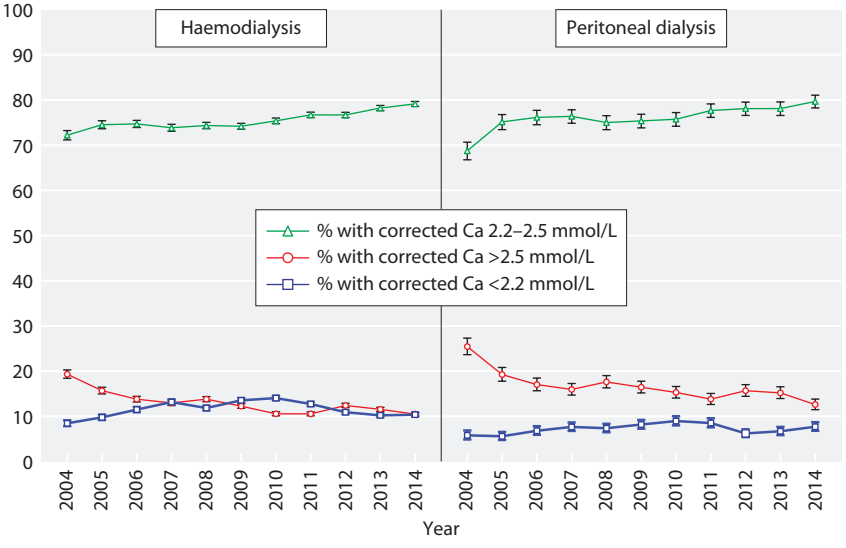

Fig. 9.10. Longitudinal change in percentage of patients with adjusted calcium <2.2 mmol/L, 2.2–2.5 mmol/L and >2.5 mmol/L by dialysis modality 2004–2014

Table 9.11. Summary statistics for PTH in haemodialysis patients in 2014

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	99.8	397	41.9	44.2	28	15	57
B QEH	96.8	864	41.3	40.4	31	15	55
Basldn	100.0	157	38.4	38.0	27	12	47
Bradfd	97.5	191	38.7	40.9	26	14	48
Brightn	97.5	388	46.6	50.3	30	15	61
Bristol	98.4	487	36.7	38.2	26	13	47
Camb	65.0	234	26.6	26.7	21	7	37
Carlis	98.3	59	25.5	25.6	18	9	33
Carsh	90.8	660	59.7	56.0	44	23	74
Chelms	98.4	125	44.5	34.0	37	22	57
Colchr	91.9	102	27.8	27.5	23	12	33
Covnt	98.2	324	37.4	41.2	25	12	45
Derby	99.6	219	34.3	25.5	29	18	44
Donc	100.0	166	49.1	42.8	36	24	62
Dorset	98.1	259	28.0	35.0	18	10	33
Dudley	95.6	153	31.1	34.1	21	10	36
Exeter	99.5	381	22.7	32.0	14	7	28
Glouc	100.0	204	39.7	43.5	27	15	48
Hull	96.4	291	44.8	48.8	31	13	58
Ipswi	99.1	114	34.5	44.9	22	11	38
Kent	98.9	370	54.2	50.0	38	19	67
L Barts	99.0	896	45.0	44.1	36	19	56
L Guys	64.4	396	51.4	53.0	36	17	69
L Kings	97.6	492	43.5	44.5	29	13	55
L Rfree	99.6	661	43.4	38.9	32	17	59
L St.G	95.4	271	59.3	51.1	45	21	81
L West	74.5	977	65.5	65.6	45	22	87
Leeds	99.4	468	38.5	38.3	25	13	51
Leic	96.9	811	42.1	43.5	29	12	60
Liv Ain	98.0	147	21.6	23.4	14	6	27
Liv Roy	96.2	330	36.8	36.2	25	13	48
M RI	88.0	416	46.6	46.4	33	17	63
Middlbr	94.1	287	51.8	46.0	38	21	70
Newc	100.0	266	47.6	41.4	35	20	61
Norwch	95.8	296	35.2	33.5	26	14	48
Nottm	99.7	340	40.3	43.3	29	15	50
Oxford	98.1	407	47.6	41.6	36	18	63
Plymth	96.9	125	37.5	39.4	28	12	42
Ports	95.7	536	47.5	45.4	35	17	60
Prestn	99.8	520	43.1	41.6	31	15	54
Redng	100.0	265	44.6	43.4	37	19	58
Salford	98.7	377	45.1	43.6	31	17	58
Sheff	99.3	551	40.1	39.0	31	17	51
Shrew	98.9	172	39.7	42.7	29	10	57
Stevng	98.2	439	42.1	32.9	38	19	57
Sthend	96.4	106	55.0	55.9	37	20	63
Stoke	78.6	242	45.1	37.8	34	19	62
Sund	96.0	192	41.3	42.5	27	12	57
Truro	99.3	135	22.7	24.8	16	7	28
Wirral	97.9	185	36.8	28.4	29	16	51
Wolve	97.6	280	44.3	53.8	26	13	53
York	94.4	117	25.5	29.6	16	7	36

Table 9.11. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
N Ireland							
Antrim	100.0	111	35.6	41.0	25	16	42
Belfast	97.9	185	28.7	42.9	17	8	35
Newry	98.8	85	29.9	34.2	22	13	39
Ulster	100.0	94	24.7	22.0	20	8	30
West NI	100.0	99	34.2	33.4	27	11	46
Wales							
Bangor	100.0	78	29.1	25.7	21	12	40
Cardff	98.3	450	46.3	44.9	35	17	59
Clwyd	96.4	80	37.3	34.7	26	12	53
Swanse	70.8	228	39.7	39.0	32	17	49
Wrexm	94.1	96	26.3	25.5	20	9	35
England	**93.8**	**17,848**	**43.6**	**44.8**	**30**	**15**	**57**
N Ireland	**99.1**	**574**	**30.5**	**37.0**	**21**	**10**	**38**
Wales	**89.4**	**932**	**40.4**	**40.2**	**30**	**15**	**51**
E, W & NI	**93.8**	**19,354**	**43.1**	**44.4**	**30**	**15**	**55**

Table 9.12. Percentage of haemodialysis patients within, below and above the range for PTH (16–72 pmol/L) in 2014

Centre	*N*	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
England									
B Heart	397	55.4	50.5	60.2	27.5	17.1	−0.8	−7.7	6.1
B QEH	864	60.2	56.9	63.4	25.5	14.4	0.7	−4.0	5.4
Basldn	157	58.6	50.8	66.0	28.7	12.7	−9.2	−19.9	1.6
Bradfd	191	56.0	48.9	62.9	30.9	13.1	4.1	−6.0	14.2
Brightn	388	55.7	50.7	60.5	25.8	18.6	−1.1	−8.6	6.3
Bristol	487	59.1	54.7	63.4	28.5	12.3	1.8	−4.4	8.0
Camb	234	54.7	48.3	61.0	39.7	5.6	−4.8	−13.6	3.9
Carlis	59	50.9	38.3	63.3	42.4	6.8	−8.8	−26.8	9.2
Carsh	660	57.1	53.3	60.9	16.4	26.5	−0.6	−6.3	5.1
Chelms	125	69.6	61.0	77.0	14.4	16.0	2.3	−9.6	14.2
Colchr	102	58.8	49.1	67.9	34.3	6.9	9.8	−3.9	23.5
Covnt	324	51.5	46.1	57.0	34.6	13.9	−4.1	−11.6	3.5
Derby	219	75.8	69.7	81.0	18.7	5.5	3.2	−5.2	11.5
Donc	166	74.7	67.5	80.7	9.6	15.7	2.8	−7.1	12.6
Dorset	259	50.2	44.1	56.3	42.5	7.3	0.0	−8.8	8.8
Dudley	153	52.3	44.4	60.1	39.2	8.5	−6.5	−17.7	4.7
Exeter	381	42.3	37.4	47.3	53.0	4.7	−0.1	−7.2	7.0
Glouc	204	59.8	52.9	66.3	27.0	13.2	−5.3	−14.8	4.3
Hull	291	53.6	47.9	59.3	28.5	17.9	0.4	−7.8	8.5

Table 9.12. Continued

Centre	*N*	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
Ipswi	114	58.8	49.5	67.4	31.6	9.7	9.2	−3.7	22.1
Kent	370	66.2	61.2	70.9	12.2	21.6	−0.3	−7.1	6.5
L Barts	896	65.5	62.3	68.6	19.3	15.2	8.2	3.7	12.8
L Guys	396	53.0	48.1	57.9	23.5	23.5	3.7	−3.1	10.5
L Kings	492	51.6	47.2	56.0	29.5	18.9	2.0	−4.4	8.3
L Rfree	661	62.0	58.3	65.7	21.5	16.5	1.1	−4.1	6.4
L St.G	271	50.6	44.6	56.5	17.7	31.7	−3.9	−12.4	4.7
L West	977	49.7	46.6	52.9	18.6	31.6	−1.2	−5.6	3.1
Leeds	468	54.9	50.4	59.4	29.5	15.6	0.4	−6.0	6.8
Leic	811	51.1	47.6	54.5	31.1	17.9	3.4	−1.4	8.3
Liv Ain	147	38.1	30.6	46.2	55.8	6.1	−5.4	−16.6	5.9
Liv Roy	330	55.5	50.1	60.7	31.5	13.0	1.8	−5.7	9.4
M RI	416	56.5	51.7	61.2	24.0	19.5	−1.9	−8.7	4.8
Middlbr	287	57.5	51.7	63.1	19.9	22.7	−4.1	−12.0	3.8
Newc	266	60.5	54.5	66.2	19.9	19.6	0.8	−7.6	9.2
Norwch	296	63.5	57.9	68.8	28.7	7.8	0.8	−7.0	8.5
Nottm	340	58.8	53.5	63.9	26.8	14.4	−1.6	−8.9	5.7
Oxford	407	58.7	53.9	63.4	20.2	21.1	2.7	−4.1	9.5
Plymth	125	56.0	47.2	64.4	32.0	12.0	−1.3	−13.8	11.2
Ports	536	58.6	54.4	62.7	21.8	19.6	2.1	−4.0	8.3
Prestn	520	58.3	54.0	62.4	26.0	15.8	1.6	−4.5	7.6
Redng	265	65.7	59.7	71.1	20.0	14.3	−2.0	−10.1	6.0
Salford	377	58.9	53.8	63.8	22.8	18.3	−0.7	−8.1	6.7
Sheff	551	63.3	59.2	67.3	23.4	13.3	2.4	−3.4	8.1
Shrew	172	57.0	49.5	64.2	30.8	12.2	7.6	−2.9	18.0
Stevng	439	66.5	62.0	70.8	19.8	13.7	−2.6	−8.8	3.7
Sthend	106	57.6	48.0	66.6	20.8	21.7	−6.1	−19.4	7.3
Stoke	242	59.9	53.6	65.9	19.4	20.7	−7.3	−16.1	1.4
Sund	192	49.5	42.5	56.5	33.9	16.7	−1.9	−12.1	8.3
Truro	135	47.4	39.1	55.8	48.2	4.4	6.1	−5.7	17.9
Wirral	185	62.7	55.5	69.4	24.9	12.4	−3.5	−13.1	6.2
Wolve	280	50.4	44.5	56.2	32.1	17.5	−6.6	−15.0	1.8
York	117	46.2	37.3	55.2	47.9	6.0	−3.4	−16.1	9.2
N Ireland									
Antrim	111	73.9	64.9	81.2	21.6	4.5	11.4	−0.5	23.3
Belfast	185	46.0	38.9	53.2	46.0	8.1	−6.9	−16.9	3.2
Newry	85	57.7	47.0	67.7	36.5	5.9	−1.9	−16.7	13.0
Ulster	94	52.1	42.1	62.0	41.5	6.4	6.1	−7.9	20.0
West NI	99	58.6	48.7	67.9	31.3	10.1	−12.4	−25.4	0.5
Wales									
Bangor	78	61.5	50.4	71.6	33.3	5.1	−5.9	−20.7	8.8
Cardff	450	59.8	55.2	64.2	21.1	19.1	−5.8	−12.1	0.5
Clwyd	80	52.5	41.6	63.2	31.3	16.3	−1.7	−17.6	14.2
Swanse	228	66.2	59.9	72.1	22.8	11.0	4.5	−4.3	13.3
Wrexm	96	55.2	45.2	64.8	39.6	5.2	1.5	−12.8	15.7
England	**17,848**	**57.3**	**56.6**	**58.0**	**25.9**	**16.8**	**0.4**	**−0.6**	**1.5**
N Ireland	**574**	**56.3**	**52.2**	**60.3**	**36.6**	**7.1**	**−1.5**	**−7.1**	**4.2**
Wales	**932**	**60.4**	**57.2**	**63.5**	**25.3**	**14.3**	**−2.3**	**−6.7**	**2.1**
E, W & NI	**19,354**	**57.4**	**56.7**	**58.1**	**26.2**	**16.4**	**0.3**	**−0.7**	**1.2**

Table 9.13. Summary statistics for PTH in peritoneal dialysis patients in 2014

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	93.8	30	39.8	21.1	42	21	53
B QEH	100.0	117	38.0	57.3	24	16	41
Basldn	96.2	25	44.7	27.2	46	24	55
Bradfd	93.8	15	42.3	31.7	37	21	53
Brightn	90.9	50	34.9	30.4	25	11	55
Bristol	96.4	53	33.1	29.2	27	15	36
Camb	87.1	27	39.6	36.3	27	15	61
Carlis	91.7	22	26.6	18.5	24.5	12	32
Carsh	84.2	101	59.2	42.7	46	26	79
Chelms	89.5	17	50.6	36.1	41	22	74
Colchr*							
Covnt	91.8	78	25.3	25.8	18	10	31
Derby	98.6	70	34.3	27.6	26.5	18	44
Donc	95.8	23	38.7	21.0	33	21	59
Dorset	76.1	35	20.7	16.2	17	9	31
Dudley	94.0	47	27.2	21.3	20	12	39
Exeter	97.6	81	25.6	25.2	18	11	30
Glouc	59.0	23	42.4	31.5	36	21	60
Hull	86.6	58	31.1	27.0	22	14	42
Ipswi	96.7	29	42.7	37.7	32	17	58
Kent	98.3	57	42.8	34.1	29	19	57
L Barts	94.5	188	37.0	30.0	30	15.5	48
L Guys	65.4	17	39.5	22.5	34	23	43
L Kings	96.2	76	54.9	44.5	44.5	22.5	73
L Rfree	87.2	109	39.6	33.3	32	16	57
L St.G	100.0	45	46.7	42.6	35	19	62
L West	86.0	49	47.7	35.2	41	25	59
Leeds	100.0	49	36.9	21.1	35	24	49
Leic	93.5	101	40.3	36.0	31	16	47
Liv Ain	94.3	33	24.4	18.9	20	13	31
Liv Roy	95.9	47	29.8	21.4	24	16	37
M RI	85.3	52	38.2	26.0	39	20.5	50
Middlbr	61.5	8					
Newc	90.9	40	47.4	36.4	42	23	59.5
Norwch	76.7	23	43.2	30.4	36	26	52
Nottm	98.6	71	46.3	36.5	37	22	64
Oxford	97.4	74	35.8	30.3	29.5	15	46
Plymth	90.9	30	17.9	14.3	15.5	9	22
Ports	81.8	54	44.7	44.4	32.5	16	54
Prestn	100.0	46	38.5	28.5	32.5	20	51
Redng	96.8	60	35.2	26.5	28	19	43.5
Salford	91.7	66	44.0	33.7	34	19	62
Sheff	84.6	44	37.1	28.1	28.5	17	51.5
Shrew	84.6	22	78.3	114.9	48	29	67
Stevng	96.2	25	30.0	19.8	29	10	48
Sthend	81.3	13	32.4	19.6	33	17	45
Stoke	100.0	72	51.4	32.2	47.5	26.5	75
Sund	100.0	14	22.1	17.0	20	7	29
Truro	100.0	18	26.4	15.0	20	17	35
Wirral	80.0	16	25.3	18.6	17	11	44
Wolve	93.1	67	39.3	29.5	33	20	51
York	100.0	21	35.1	33.0	26	14	42

Table 9.13. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
N Ireland							
Antrim	100.0	13	30.3	27.7	22	11	44
Belfast	100.0	15	33.4	23.9	27	13	45
Newry	100.0	14	27.4	16.5	30.5	12	41
Ulster	100.0	4					
West NI	100.0	11	20.7	12.2	21	7	30
Wales							
Bangor	93.3	14	33.2	24.9	24	18	44
Cardff	76.4	55	38.8	29.0	30	18	53
Clwyd	72.7	8					
Swanse	98.0	49	41.1	32.7	36	19	54
Wrexm	100.0	23	42.0	20.6	41	23	56
England	**91.8**	**2,508**	**38.9**	**35.4**	**30**	**16**	**51**
N Ireland	**100.0**	**57**	**29.6**	**22.6**	**24**	**12**	**41**
Wales	**87.1**	**149**	**39.5**	**28.8**	**31**	**20**	**54**
E, W & NI	**91.7**	**2,714**	**38.7**	**34.9**	**30**	**17**	**51**

Blank cells: centres excluded from analyses due to small numbers or poor data completeness
*No PD patients

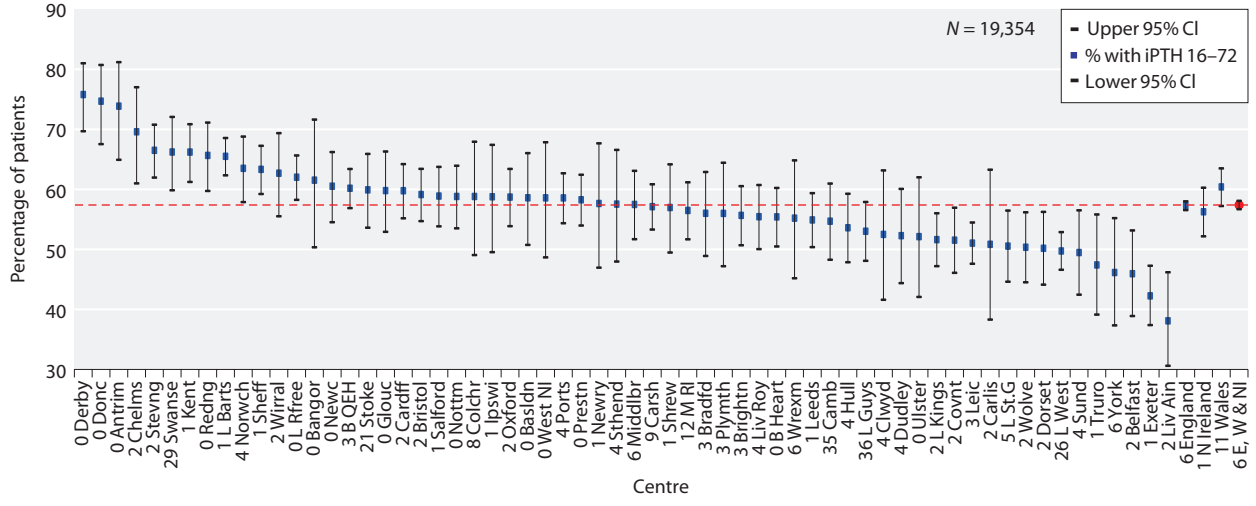

Fig. 9.11. Percentage of haemodialysis patients with PTH within range (16–72 pmol/L) by centre in 2014

Table 9.14. Percentage of peritoneal dialysis patients within, below and above the range for PTH (16–72 pmol/L) in 2014

Centre	*N*	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
England									
B Heart	30	70.0	51.7	83.6	20.0	10.0	10.0	−14.0	34.0
B QEH	117	66.7	57.7	74.6	23.9	9.4	4.8	−7.3	16.8
Basldn	25	64.0	44.0	80.1	16.0	20.0	−2.7	−27.9	22.6
Bradfd	15	73.3	46.7	89.6	13.3	13.3	25.5	−4.8	55.8
Brightn	50	50.0	36.5	63.5	32.0	18.0	−9.4	−27.7	9.0
Bristol	53	66.0	52.4	77.4	28.3	5.7	−1.2	−19.0	16.6
Camb	27	59.3	40.3	75.8	25.9	14.8	−9.2	−37.1	18.8
Carlis	22	59.1	38.2	77.2	36.4	4.6	−20.9	−47.9	6.1

Table 9.14. Continued

Centre	*N*	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
Carsh	101	64.4	54.6	73.1	7.9	27.7			
Chelms	17	58.8	35.2	79.0	11.8	29.4	−4.3	−36.2	27.6
Covnt	78	53.9	42.8	64.6	41.0	5.1	−5.2	−21.5	11.0
Derby	70	72.9	61.3	82.0	21.4	5.7	−0.1	−14.6	14.4
Donc	23	82.6	61.8	93.3	13.0	4.4	10.2	−12.3	32.7
Dorset	35	48.6	32.7	64.7	48.6	2.9	−22.9	−45.2	−0.5
Dudley	47	68.1	53.6	79.8	27.7	4.3	19.3	−1.0	39.6
Exeter	81	55.6	44.6	66.0	40.7	3.7	−1.6	−17.9	14.7
Glouc	23	60.9	40.2	78.2	21.7	17.4	−16.1	−41.7	9.6
Hull	58	67.2	54.3	78.0	25.9	6.9	9.7	−9.8	29.2
Ipswi	29	72.4	53.8	85.6	17.2	10.3	17.9	−8.6	44.3
Kent	57	64.9	51.8	76.1	17.5	17.5	1.3	−16.5	19.0
L Barts	188	63.3	56.2	69.9	25.0	11.7	6.5	−3.7	16.7
L Guys	17	82.4	57.3	94.2	5.9	11.8	13.6	−15.5	42.7
L Kings	76	56.6	45.3	67.2	18.4	25.0	0.0	−15.8	15.8
L Rfree	109	61.5	52.0	70.1	24.8	13.8	−0.5	−14.0	13.0
L St.G	45	64.4	49.6	76.9	17.8	17.8	−1.4	−21.6	18.7
L West	49	63.3	49.1	75.5	18.4	18.4	1.7	−17.2	20.6
Leeds	49	73.5	59.5	83.9	20.4	6.1	9.0	−8.2	26.1
Leic	101	62.4	52.6	71.3	22.8	14.9	1.2	−11.6	14.1
Liv Ain	33	57.6	40.5	73.0	39.4	3.0	28.4	3.6	53.2
Liv Roy	47	70.2	55.8	81.5	23.4	6.4	7.7	−11.2	26.6
M RI	52	67.3	53.6	78.6	23.1	9.6	−8.9	−25.4	7.6
Newc	40	62.5	46.8	76.0	20.0	17.5	9.2	−14.1	32.5
Norwch	23	69.6	48.5	84.8	17.4	13.0	−1.0	−25.3	23.2
Nottm	71	69.0	57.4	78.7	14.1	16.9	2.3	−13.3	18.0
Oxford	74	67.6	56.2	77.2	25.7	6.8	8.1	−7.1	23.3
Plymth	30	50.0	32.8	67.2	50.0	0.0	0.0	−27.5	27.5
Ports	54	57.4	44.0	69.8	24.1	18.5	8.2	−9.7	26.0
Prestn	46	76.1	61.8	86.2	15.2	8.7	6.9	−10.7	24.4
Redng	60	80.0	68.0	88.3	11.7	8.3	5.8	−9.1	20.7
Salford	66	69.7	57.6	79.5	16.7	13.6	14.8	−1.3	30.8
Sheff	44	65.9	50.9	78.3	22.7	11.4	−2.0	−20.8	16.8
Shrew	22	72.7	51.1	87.2	9.1	18.2	3.5	−22.2	29.2
Stevng	25	64.0	44.0	80.1	32.0	4.0	−11.0	−35.1	13.1
Sthend	13	76.9	47.9	92.4	23.1	0.0			
Stoke	72	61.1	49.5	71.6	12.5	26.4	−9.3	−24.8	6.2
Sund	14	57.1	31.6	79.4	42.9	0.0			
Truro	18	77.8	53.5	91.4	22.2	0.0	2.8	−25.8	31.4
Wirral	16	50.0	27.3	72.7	50.0	0.0	−22.2	−54.3	9.8
Wolve	67	68.7	56.7	78.6	17.9	13.4	−0.2	−15.3	15.0
York	21	47.6	27.9	68.2	38.1	14.3	−16.4	−44.8	12.1
N Ireland									
Antrim	13	46.2	22.4	71.8	46.2	7.7	−18.1	−55.1	18.8
Belfast	15	66.7	40.6	85.4	26.7	6.7	9.0	−21.5	39.5
Newry	14	71.4	44.0	88.9	28.6	0.0	0.8	−31.2	32.9
West NI	11	63.6	33.9	85.7	36.4	0.0	6.5	−32.0	45.0
Wales									
Bangor	14	71.4	44.0	88.9	21.4	7.1	−19.5	−48.6	9.7
Cardff	55	72.7	59.6	82.8	16.4	10.9	11.1	−6.0	28.1
Swanse	49	71.4	57.4	82.3	18.4	10.2	3.3	−15.0	21.7
Wrexm	23	87.0	66.5	95.7	4.4	8.7	2.8	−18.7	24.2
England	**2,508**	**64.5**	**62.6**	**66.4**	**23.3**	**12.2**	**1.6**	**−1.0**	**4.3**
N Ireland	**57**	**61.4**	**48.3**	**73.1**	**33.3**	**5.3**	**1.4**	**−15.4**	**18.2**
Wales	**149**	**73.8**	**66.2**	**80.3**	**15.4**	**10.7**	**4.7**	**−5.5**	**14.9**
E, W & NI	**2,714**	**65.0**	**63.1**	**66.7**	**23.1**	**12.0**	**1.8**	**−0.7**	**4.4**

Blank cells: no data available for 2013

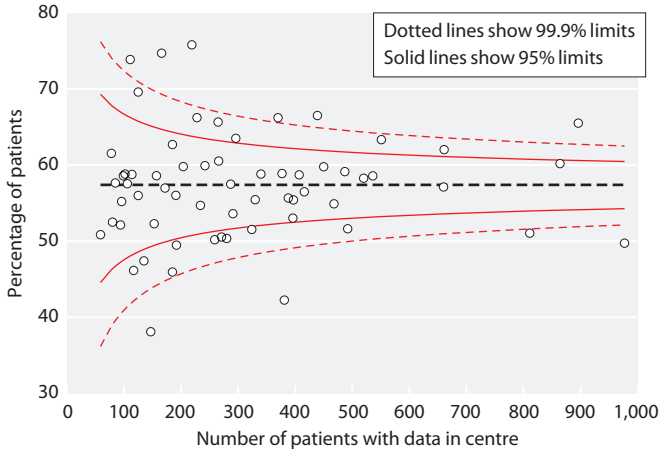

Fig. 9.12. Funnel plot of percentage of haemodialysis patients with PTH within range (16–72 pmol/L) by centre in 2014

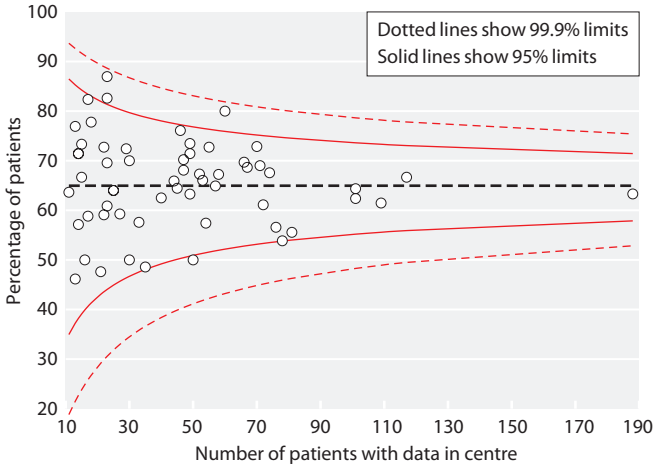

Fig. 9.14. Funnel plot of percentage of peritoneal dialysis patients with PTH within range (16–72 pmol/L) by centre in 2014

patients; and of all three parameters in 50.3% of HD and 52.5% of PD patients (tables 9.15, 9.16).

Figures 9.18 and 9.19 are funnel plots of all centres who contributed data to these analyses based on the size of the centre and the percentage of patients achieving the control of all three BMD parameters. In HD patients, there was a negative trend observed between centre size and the simultaneous control of all three BMD parameters as identified in this analysis.

No such trend was observed in PD patients.

Bicarbonate

In 2014 the following Renal Association clinical practice guidelines regarding bicarbonate management were applicable:

Haemodialysis Guideline 6.3: Pre-dialysis serum bicarbonate concentrations

'We suggest that pre-dialysis serum bicarbonate concentrations, measured with minimum delay after venepuncture, should be between 18 and 24 mmol/L' [7].

Peritoneal Dialysis Guideline 6.2 – PD: Metabolic factors

'We recommend that plasma bicarbonate should be maintained within the normal range' [8].

A total of 18,671 HD and 2,603 PD patients' data were available for serum bicarbonate analysis from England, Wales and Northern Ireland in 2014. Data were 90.5%

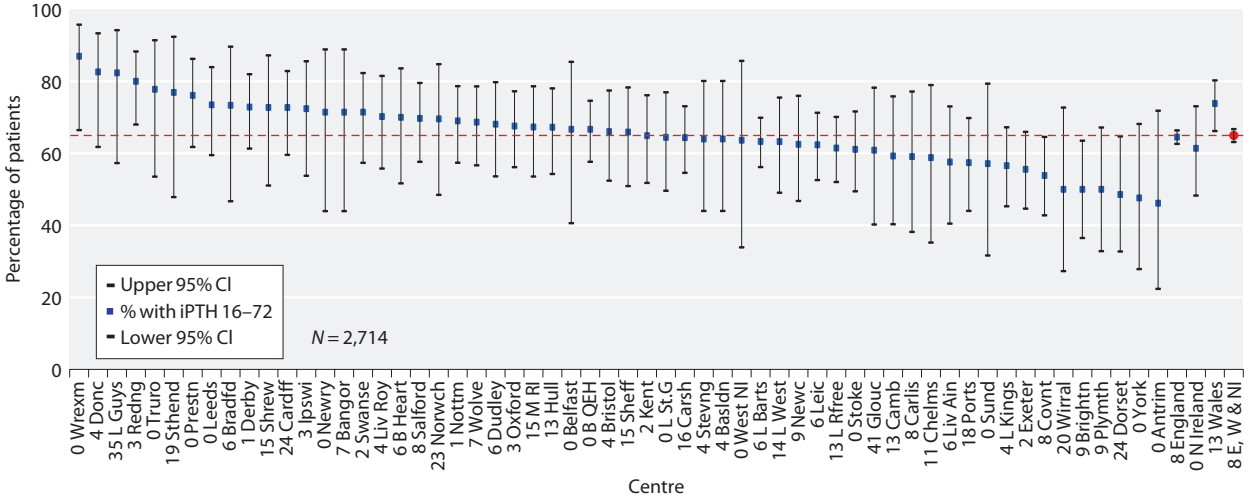

Fig. 9.13. Percentage of peritoneal dialysis patients with PTH within range (16–72 pmol/L) by centre in 2014

Table 9.15. Percentage of haemodialysis patients within the ranges specified for the simultaneous combinations of control of bone and mineral disorder parameters in preventing severe hyperparathyroidism in 2014

		Number of parameters			
Centre	*N*	None	One	Two	Three
England					
B Heart	397	5.3	14.9	37.3	42.6
B QEH	842	1.5	12.2	32.4	53.8
Basldn	155	0.6	7.7	36.8	54.8
Bradfd	191	2.6	9.4	29.8	58.1
Brightn	388	1.0	15.7	31.7	51.5
Bristol	487	0.8	11.7	34.3	53.2
Camb	226	0.0	8.4	37.2	54.4
Carlis	59	0.0	8.5	42.4	49.2
Carsh	655	2.6	15.7	37.3	44.4
Chelms	125	0.0	6.4	36.0	57.6
Colchr	102	0.0	7.8	27.5	64.7
Covnt	324	1.9	14.2	33.3	50.6
Derby	219	0.9	8.2	45.2	45.7
Donc	166	1.2	10.2	30.7	57.8
Dorset	258	0.0	9.3	28.7	62.0
Dudley	153	2.0	7.8	39.9	50.3
Exeter	381	0.0	6.6	29.1	64.3
Glouc	204	0.5	8.8	33.3	57.4
Hull	291	1.7	10.0	32.3	56.0
Ipswi	114	1.8	6.1	29.8	62.3
Kent	370	2.7	14.3	41.9	41.1
L Barts	894	1.8	15.9	39.8	42.5
L Guys	391	1.5	15.1	36.1	47.3
L Kings	492	0.8	10.6	29.9	58.7
L Rfree	661	1.5	14.2	32.7	51.6
L St.G	271	1.8	14.4	39.9	43.9
L West	810	3.2	19.9	40.7	36.2
Leeds	468	2.1	13.5	36.3	48.1
Leic	811	1.2	14.3	40.4	44.0
Liv Ain	147	1.4	8.2	25.9	64.6
Liv Roy	329	0.6	12.2	35.6	51.7
M RI	413	3.1	13.3	36.1	47.5
Middlbr	287	2.8	21.6	33.1	42.5
Newc	266	4.5	11.3	30.1	54.1
Norwch	295	1.7	8.8	31.5	58.0
Nottm	340	1.2	10.0	33.8	55.0
Oxford	407	2.0	16.0	38.6	43.5
Plymth	123	2.4	11.4	29.3	56.9
Ports	529	1.9	14.6	40.8	42.7
Prestn	490	2.9	12.9	37.3	46.9
Redng	265	0.8	8.7	27.9	62.6
Salford	377	1.9	13.5	35.0	49.6
Sheff	551	0.7	11.4	36.5	51.4
Shrew	172	2.9	11.0	33.1	52.9
Stevng	439	1.8	8.7	34.6	54.9
Sthend	106	1.9	18.9	34.9	44.3
Stoke	236	1.7	13.1	38.6	46.6
Truro	135	2.2	5.2	30.4	62.2
Wirral	184	1.1	16.3	29.9	52.7
Wolve	279	3.9	12.5	35.1	48.4
York	117	0.9	6.8	21.4	70.9

Table 9.15. Continued

Centre	*N*	Number of parameters			
		None	One	Two	Three
N Ireland					
Antrim	111	0.9	7.2	28.8	63.1
Belfast	185	1.1	10.8	30.3	57.8
Newry	85	4.7	5.9	36.5	52.9
Ulster	92	2.2	10.9	33.7	53.3
West NI	99	2.0	11.1	38.4	48.5
Wales					
Bangor	78	0.0	10.3	20.5	69.2
Cardff	450	2.0	13.6	38.0	46.4
Clwyd	80	1.3	18.8	37.5	42.5
Swanse	228	3.1	7.9	32.9	56.1
Wrexm	96	1.0	12.5	26.0	60.4
England	**17,392**	**1.8**	**12.8**	**35.3**	**50.0**
N Ireland	**572**	**1.9**	**9.4**	**32.9**	**55.8**
Wales	**932**	**1.9**	**12.2**	**34.0**	**51.8**
E, W & NI	**18,896**	**1.8**	**12.7**	**35.2**	**50.3**

Table 9.16. Percentage of peritoneal dialysis patients within the ranges specified for the simultaneous combinations of control of bone and mineral disorder parameters in preventing severe hyperparathyroidism in 2014

Centre	*N*	Number of parameters			
		None	One	Two	Three
England					
B Heart	30	3.3	10.0	33.3	53.3
B QEH	116	1.7	8.6	31.9	57.8
Basldn	25	8.0	12.0	28.0	52.0
Bradfd	14	0.0	21.4	50.0	28.6
Brightn	50	2.0	10.0	34.0	54.0
Bristol	53	1.9	11.3	47.2	39.6
Camb	25	0.0	12.0	20.0	68.0
Carlis	22	0.0	13.6	22.7	63.6
Carsh	100	3.0	17.0	30.0	50.0
Chelms	17	0.0	11.8	52.9	35.3
Covnt	74	0.0	6.8	29.7	63.5
Derby	70	0.0	12.9	38.6	48.6
Donc	23	0.0	4.3	39.1	56.5
Dorset	35	0.0	2.9	22.9	74.3
Dudley	47	0.0	21.3	42.6	36.2
Exeter	81	0.0	4.9	27.2	67.9
Glouc	23	0.0	26.1	30.4	43.5
Hull	58	0.0	13.8	31.0	55.2
Ipswi	29	3.4	6.9	34.5	55.2
Kent	57	5.3	10.5	42.1	42.1
L Barts	186	3.2	9.7	33.3	53.8
L Guys	17	0.0	11.8	17.6	70.6
L Kings	76	1.3	10.5	48.7	39.5
L Rfree	109	2.8	11.9	33.9	51.4
L St.G	45	0.0	17.8	26.7	55.6
L West	47	4.3	8.5	61.7	25.5
Leeds	49	2.0	4.1	34.7	59.2
Leic	101	2.0	16.8	34.7	46.5
Liv Ain	33	0.0	6.1	57.6	36.4

Table 9.16. Continued

Centre	*N*	Number of parameters			
		None	One	Two	Three
Liv Roy	47	2.1	2.1	36.2	59.6
M RI	52	0.0	9.6	40.4	50.0
Newc	40	2.5	20.0	32.5	45.0
Norwch	23	0.0	21.7	39.1	39.1
Nottm	70	2.9	11.4	34.3	51.4
Oxford	74	1.4	4.1	36.5	58.1
Plymth	30	0.0	3.3	13.3	83.3
Ports	52	7.7	5.8	34.6	51.9
Prestn	46	0.0	15.2	26.1	58.7
Redng	60	1.7	8.3	20.0	70.0
Salford	66	1.5	9.1	54.5	34.8
Sheff	44	0.0	4.5	29.5	65.9
Shrew	22	0.0	13.6	50.0	36.4
Stevng	25	0.0	8.0	8.0	84.0
Sthend	13	0.0	7.7	53.8	38.5
Stoke	70	4.3	12.9	32.9	50.0
Sund	14	0.0	28.6	21.4	50.0
Truro	18	0.0	5.6	33.3	61.1
Wirral	16	0.0	6.3	43.8	50.0
Wolve	67	3.0	14.9	41.8	40.3
York	21	0.0	9.5	42.9	47.6
N Ireland					
Antrim	13	7.7	7.7	23.1	61.5
Belfast	15	0.0	13.3	53.3	33.3
Newry	14	0.0	7.1	28.6	64.3
West NI	11	0.0	0.0	18.2	81.8
Wales					
Bangor	14	0.0	14.3	50.0	35.7
Cardff	55	0.0	12.7	27.3	60.0
Swanse	49	2.0	10.2	30.6	57.1
Wrexm	23	0.0	8.7	43.5	47.8
England	**2,482**	**1.8**	**10.8**	**35.1**	**52.3**
N Ireland	**53**	**1.9**	**7.5**	**32.1**	**58.5**
Wales	**141**	**0.7**	**11.3**	**33.3**	**54.6**
E, W & NI	**2,676**	**1.8**	**10.8**	**35.0**	**52.5**

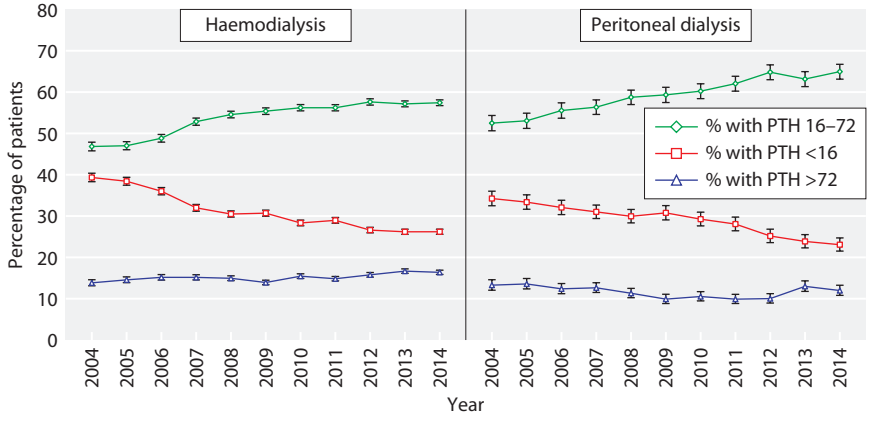

Fig. 9.15. Longitudinal change in percentage of patients with PTH within range (16–72 pmol/L), below and above range, by dialysis modality 2004–2014

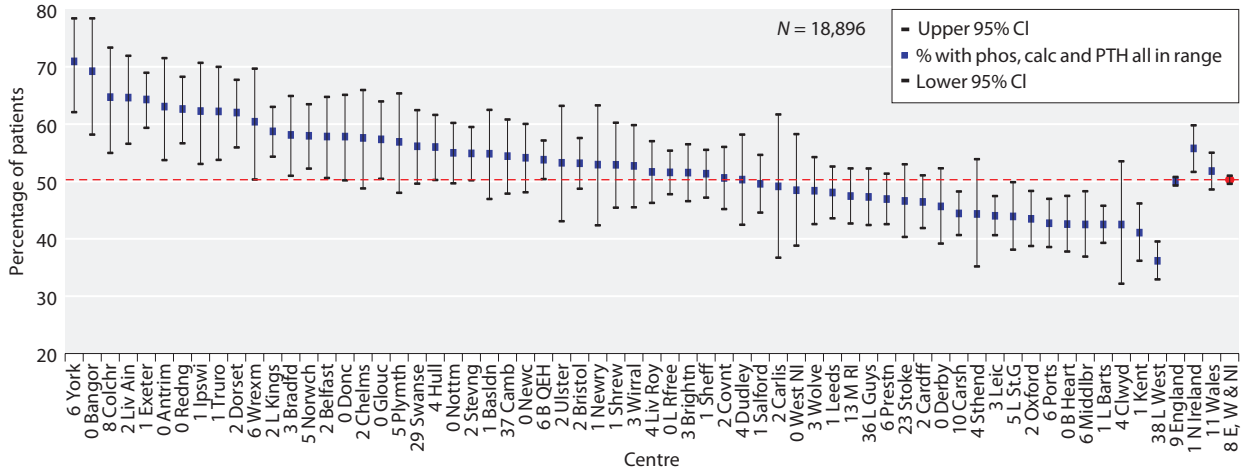

Fig. 9.16. Percentage of HD patients achieving simultaneous control of all three BMD parameters in preventing severe hyperparathyroidism by centre in 2014

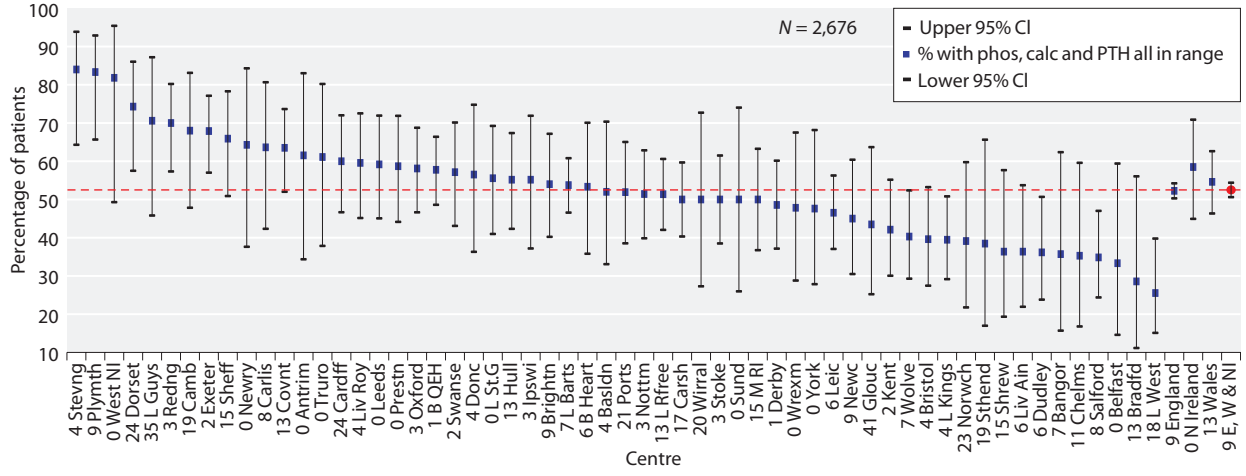

Fig. 9.17. Percentage of PD patients achieving simultaneous control of all three BMD parameters in preventing severe hyperparathyroidism by centre in 2014

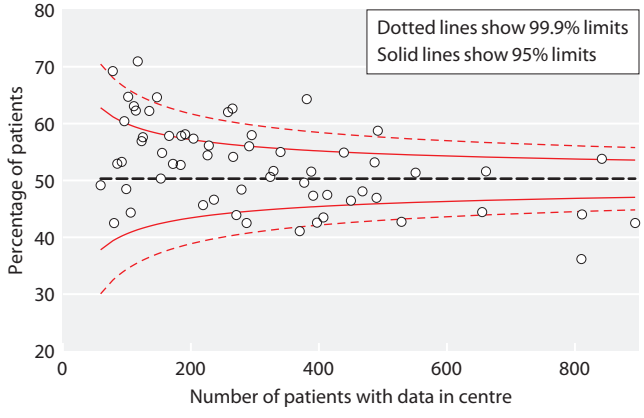

Fig. 9.18. Funnel plot for percentage of HD patients achieving simultaneous control of all three BMD parameters in preventing severe hyperparathyroidism by centre in 2014

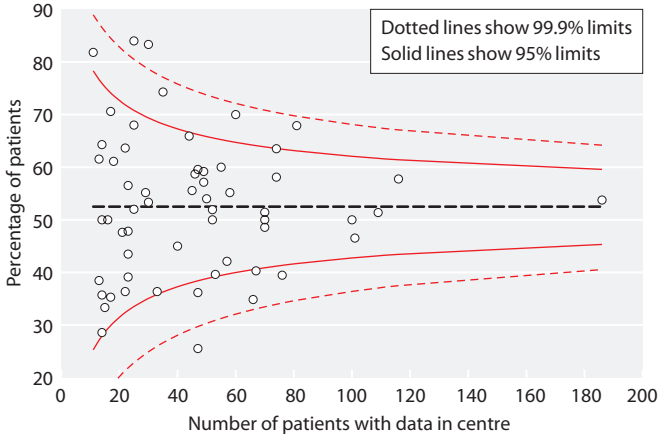

Fig. 9.19. Funnel plot for percentage of PD patients achieving simultaneous control of all three BMD parameters in preventing severe hyperparathyroidism by centre in 2014

complete for HD patients and 87.9% complete for PD patients (tables 9.17, 9.19). Data completeness for serum bicarbonate levels in HD and PD patients has not changed significantly over a decade. The proportion of HD patients with a serum bicarbonate within the audit measure range was 60.4% in 2014 (95% CI 59.7–61.1%) (table 9.18); the mean bicarbonate in HD patients was 23.5 mmol/L (table 9.17). The proportion with a serum bicarbonate within the audit standard in PD patients was 81.8% (CI 80.3–83.2%) (table 9.20). The mean bicarbonate level in PD patients was 25.4 mmol/L (table 9.19).

As in previous reports, inter-centre variation was observed in attainment of the audit standard for both HD and PD groups (tables 9.18, 9.20, figures 9.20–9.23). The funnel plot of serum bicarbonate values in 2014 for HD patients (figure 9.21) showed a large dispersal of attainment, 19 centres being above average and 20 below average. In contrast the funnel plot for PD patients (figure 9.23) showed few outliers. Sample processing, case-mix, differences in dialysis, residual renal function and oral bicarbonate prescriptions may all contribute to the variation observed.

Serial trends in serum bicarbonate measures between 2004 and 2014 by dialysis modality are presented in figure 9.24. Achievement of bicarbonate audit measures has not changed over the past decade for either modality.

Table 9.17. Summary statistics for serum bicarbonate in haemodialysis patients by centre in 2014

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	98.0	390	22.7	2.8	23	21	24
B QEH	99.0	884	23.7	2.5	24	22	25
Basldn	99.4	156	22.6	2.6	23	21	24
Bradfd	100.0	196	24.0	2.7	24	23	26
Brightn	98.7	393	22.9	2.7	23	21	24
Bristol	100.0	495	22.2	2.5	22	21	24
Camb	85.6	308	25.2	3.2	25	23	27
Carlis	100.0	60	21.2	2.4	22	20	23
Carsh	56.3	409	25.0	2.0	25	24	26
Chelms	100.0	127	21.6	2.3	22	21	23
Colchr	94.6	105	23.4	2.0	24	22	25
Covnt	87.6	289	23.9	3.2	24	22	26
Derby	99.6	219	22.8	2.4	23	21	24
Donc	100.0	166	23.0	2.8	23	21	25
Dorset	98.9	261	22.0	2.6	22	21	24
Dudley	98.1	157	23.6	2.9	24	22	25
Exeter	100.0	383	23.6	2.6	24	22	25
Glouc	100.0	204	24.2	2.9	24	22	26
Hull	99.7	301	23.8	2.7	24	22	25
Ipswi	100.0	115	24.1	3.1	24	22	26
Kent	99.7	373	22.5	2.7	22	21	24
L Barts	99.8	903	22.4	3.0	22	20	24
L Guys	62.4	384	24.8	2.9	25	23	27
L Kings	100.0	504	22.4	2.0	22	21	24
L Rfree	100.0	664	21.0	2.9	21	19	23
L St.G	97.5	277	27.6	3.4	27	25	30
L West	45.2	593					
Leeds	100.0	471	22.2	3.2	22	20	24
Leic	98.9	828	24.7	3.1	25	23	27
Liv Ain	100.0	150	25.5	3.5	25	23	27
Liv Roy	99.7	342	25.5	3.4	25	23	28
M RI	93.5	442	22.5	2.7	23	21	24
Middlbr	100.0	305	26.3	3.1	26	24	28
Newc	99.3	264	22.7	3.2	23	20	25
Norwch	99.4	307	21.9	2.7	22	20	23
Nottm	93.6	319	25.2	2.8	25	24	27
Oxford	100.0	415	24.2	3.4	24	22	26
Plymth	97.7	126	24.9	2.3	25	23	26
Ports	92.9	520	23.7	2.9	24	22	26

Table 9.17. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Prestn	99.2	517	24.5	2.7	25	23	26
Redng	100.0	265	24.6	2.9	25	23	27
Salford	11.3	43					
Sheff	100.0	555	23.7	3.2	24	22	26
Shrew	99.4	173	23.9	3.2	24	22	25
Stevng	100.0	447	24.0	3.2	24	22	26
Sthend	100.0	110	24.9	3.3	25	23	27
Stoke	79.9	246	25.5	3.1	25	24	27
Sund	100.0	200	27.5	3.0	28	26	30
Truro	100.0	136	24.0	2.9	24	22	26
Wirral	94.7	179	24.8	2.9	25	23	27
Wolve	99.7	286	20.2	2.7	20	19	22
York	100.0	124	25.3	3.0	25	23	27
N Ireland							
Antrim	100.0	111	26.0	2.5	26	24	28
Belfast	100.0	189	22.3	2.7	22	21	24
Newry	100.0	86	23.0	2.9	23	22	25
Ulster	100.0	94	24.1	2.6	24	23	26
West NI	100.0	99	22.6	2.4	23	21	24
Wales							
Bangor	100.0	78	25.4	4.1	25	23	28
Cardff	99.1	454	23.4	3.1	24	21	25
Clwyd	100.0	83	24.6	2.5	25	23	26
Swanse	100.0	322	24.5	3.5	24	22	26
Wrexm	67.7	69	22.9	2.5	23	21	25
England	**89.8**	**17,086**	**23.5**	**3.3**	**23**	**21**	**25**
N Ireland	**100.0**	**579**	**23.5**	**2.9**	**23**	**22**	**25**
Wales	**96.5**	**1,006**	**24.0**	**3.3**	**24**	**22**	**26**
E, W & NI	**90.5**	**18,671**	**23.5**	**3.3**	**23**	**21**	**26**

Blank cells: centres excluded from analyses due to poor data completeness

Table 9.18. Percentage of haemodialysis patients within, below and above the range for bicarbonate (18–24 mmol/L) by centre in 2014

Centre	*N*	% bicarb 18–24 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <18 mmol/L	% bicarb >24 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
England									
B Heart	390	75.4	70.9	79.4	2.6	22.1	−6.1	−12.3	0.2
B QEH	884	62.7	59.4	65.8	0.8	36.5	4.6	0.0	9.1
Basldn	156	77.6	70.4	83.4	1.9	20.5	1.4	−8.0	10.8
Bradfd	196	54.1	47.1	60.9	2.0	43.9	−2.7	−12.7	7.3
Brightn	393	76.8	72.4	80.8	1.8	21.4	11.0	4.6	17.5
Bristol	495	78.8	75.0	82.2	3.4	17.8	14.9	9.3	20.5
Camb	308	47.1	41.6	52.7	0.0	52.9	−11.0	−18.6	−3.3
Carlis	60	93.3	83.5	97.5	5.0	1.7	15.7	3.3	28.2
Carsh	409	37.9	33.3	42.7	0.2	61.9	−4.6	−10.6	1.5
Chelms	127	88.2	81.3	92.8	3.2	8.7	4.6	−4.4	13.5
Colchr	105	70.5	61.1	78.4	1.0	28.6	36.8	24.1	49.5
Covnt	289	55.0	49.2	60.7	2.4	42.6	−9.5	−17.3	−1.7
Derby	219	74.4	68.2	79.8	1.8	23.7	1.3	−7.1	9.7
Donc	166	72.3	65.0	78.6	1.2	26.5	33.9	23.5	44.3

Table 9.18. Continued

Centre	*N*	% bicarb 18–24 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <18 mmol/L	% bicarb >24 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
Dorset	261	81.2	76.0	85.5	4.2	14.6	3.6	−3.4	10.7
Dudley	157	57.3	49.5	64.8	3.2	39.5	−12.4	−23.0	−1.8
Exeter	383	59.0	54.0	63.8	2.4	38.6	−18.9	−25.4	−12.5
Glouc	204	52.9	46.1	59.7	1.0	46.1	−11.3	−20.9	−1.6
Hull	301	60.8	55.2	66.2	0.7	38.5	−4.1	−11.8	3.6
Ipswi	115	57.4	48.2	66.1	0.0	42.6	−16.5	−28.7	−4.3
Kent	373	76.1	71.6	80.2	3.0	20.9	−6.6	−12.4	−0.8
L Barts	903	74.0	71.0	76.7	4.2	21.8	−9.7	−13.5	−6.0
L Guys	384	47.4	42.4	52.4	0.5	52.1	−24.0	−30.7	−17.3
L Kings	504	85.3	82.0	88.2	1.0	13.7	60.9	55.9	65.8
L Rfree	664	80.0	76.8	82.8	9.9	10.1	11.6	7.0	16.3
L St.G	277	15.9	12.0	20.7	0.4	83.8	−1.8	−8.1	4.5
Leeds	471	70.9	66.7	74.8	6.6	22.5	−4.9	−10.6	0.7
Leic	828	46.6	43.2	50.0	1.8	51.6	−4.6	−9.4	0.2
Liv Ain	150	37.3	30.0	45.3	0.7	62.0	−7.6	−18.7	3.6
Liv Roy	342	40.6	35.6	45.9	0.3	59.1	−7.9	−15.3	−0.4
M RI	442	75.6	71.3	79.4	3.2	21.3	21.0	15.0	27.1
Middlbr	305	25.3	20.7	30.4	1.0	73.8	3.4	−3.3	10.1
Newc	264	66.3	60.4	71.7	4.6	29.2	45.3	37.7	52.9
Norwch	307	81.8	77.0	85.7	4.2	14.0	34.6	27.5	41.7
Nottm	319	37.3	32.2	42.7	0.9	61.8	1.4	−6.0	8.8
Oxford	415	49.6	44.9	54.4	2.9	47.5	2.4	−4.5	9.2
Plymth	126	41.3	33.0	50.1	0.8	57.9	−2.4	−14.8	10.0
Ports	520	58.7	54.4	62.8	1.9	39.4	0.3	−5.7	6.2
Prestn	517	46.4	42.2	50.7	1.6	52.0	−12.9	−18.9	−6.8
Redng	265	47.2	41.2	53.2	0.8	52.1	3.7	−4.8	12.2
Sheff	555	56.2	52.1	60.3	2.3	41.4	−2.0	−7.8	3.8
Shrew	173	56.1	48.6	63.3	2.3	41.6	−0.4	−10.8	10.0
Stevng	447	54.4	49.7	58.9	1.8	43.9	−15.4	−21.7	−9.0
Sthend	110	43.6	34.7	53.0	0.9	55.5	0.0	−13.1	13.1
Stoke	246	36.2	30.4	42.4	0.0	63.8	−12.4	−21.4	−3.5
Sund	200	18.0	13.3	24.0	0.5	81.5	6.8	−0.3	13.8
Truro	136	52.2	43.8	60.5	0.7	47.1	−24.1	−35.0	−13.1
Wirral	179	48.0	40.8	55.4	1.1	50.8	−12.4	−22.6	−2.2
Wolve	286	80.8	75.8	84.9	14.0	5.2	6.1	−0.7	13.0
York	124	41.1	32.8	50.0	0.0	58.9	−11.6	−23.8	0.6
N Ireland									
Antrim	111	27.0	19.6	36.0	0.0	73.0	−32.3	−44.4	−20.2
Belfast	189	80.4	74.2	85.5	3.7	15.9	4.8	−3.5	13.0
Newry	86	70.9	60.5	79.5	2.3	26.7	−13.6	−25.9	−1.3
Ulster	94	59.6	49.4	69.0	2.1	38.3	0.4	−13.4	14.1
West NI	99	78.8	69.6	85.7	0.0	21.2	9.6	−2.3	21.5
Wales									
Bangor	78	35.9	26.1	47.1	2.6	61.5	3.8	−10.8	18.4
Cardff	454	60.1	55.6	64.5	3.1	36.8	2.4	−4.0	8.7
Clwyd	83	44.6	34.3	55.4	1.2	54.2	−29.0	−43.8	−14.3
Swanse	322	50.6	45.2	56.1	1.2	48.1	−13.3	−20.9	−5.6
Wrexm	69	68.1	56.3	78.0	1.5	30.4	−12.1	−25.7	1.5
England	**17,086**	**60.6**	**59.8**	**61.3**	**2.9**	**36.5**	**1.8**	**0.7**	**2.8**
N Ireland	**579**	**65.1**	**61.1**	**68.9**	**1.9**	**33.0**	**−4.7**	**−10.0**	**0.6**
Wales	**1,006**	**54.5**	**51.4**	**57.5**	**2.2**	**43.3**	**−6.3**	**−10.6**	**−2.0**
E, W & NI	**18,671**	**60.4**	**59.7**	**61.1**	**2.8**	**36.8**	**1.1**	**0.1**	**2.1**

Table 9.19. Summary statistics for serum bicarbonate in peritoneal dialysis patients by centre in 2014

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	96.9	31	22.9	2.2	23	22	24
B QEH	88.9	104	24.9	2.6	25	23	27
Basldn	84.6	22	26.7	2.9	26	25	29
Bradfd	100.0	16	26.2	2.7	26	26	28
Brightn	100.0	55	24.4	2.8	25	23	26
Bristol	100.0	55	22.1	2.2	22	21	23
Camb	77.4	24	30.5	3.6	31	29	33
Carlis	100.0	24	25.0	2.8	25	23	27
Carsh	0.0	0					
Chelms	94.7	18	25.2	3.2	26	23	27
Colchr*							
Covnt	88.2	75	26.2	2.9	26	25	28
Derby	98.6	70	24.2	2.7	25	22	26
Donc	100.0	24	25.0	3.0	25	24	26
Dorset	100.0	46	24.0	4.2	24	20	27
Dudley	96.0	48	25.6	3.8	26	24	27
Exeter	100.0	83	25.6	3.1	26	24	28
Glouc	94.9	37	25.9	2.9	26	25	27
Hull	97.0	65	26.3	3.0	27	24	28
Ipswi	100.0	30	28.2	2.8	28	27	30
Kent	100.0	58	24.9	3.1	25	23	27
L Barts	98.0	195	23.9	3.2	24	22	26
L Guys	76.9	20	24.9	3.7	25	22	28
L Kings	100.0	79	25.3	2.2	25	24	27
L Rfree	79.2	99	24.4	3.5	25	23	26
L St.G	100.0	45	27.7	2.6	28	26	30
L West	77.2	44	23.1	2.4	23	21	25
Leeds	100.0	49	27.9	3.1	28	26	30
Leic	92.6	100	25.6	3.3	25	23	28
Liv Ain	100.0	35	26.0	3.6	26	25	29
Liv Roy	100.0	49	25.2	2.5	26	24	27
M RI	100.0	61	24.1	3.3	24	22	26
Middlbr	100.0	13	25.4	4.1	26	25	28
Newc	95.5	42	24.7	2.9	24	23	27
Norwch	100.0	30	21.1	2.3	21	19	23
Nottm	63.9	46	27.7	2.8	28	26	30
Oxford	88.2	67	25.4	3.3	25	23	27
Plymth	93.9	31	24.3	2.7	24	23	26
Ports	89.4	59	26.5	3.2	26	24	29
Prestn	100.0	46	26.5	3.4	27	24	28
Redng	100.0	62	27.5	2.8	27	26	29
Salford	5.6	4					
Sheff	100.0	52	24.1	3.0	24	22	26
Shrew	96.2	25	25.9	2.5	26	25	28
Stevng	92.3	24	26.6	3.3	27	25	29
Sthend	100.0	16	25.6	2.7	26	24	28
Stoke	100.0	72	26.8	3.5	27	24	29
Sund	100.0	14	24.6	2.7	25	22	27
Truro	88.9	16	26.9	2.7	27	25	29
Wirral	75.0	15	27.3	4.0	26	24	31
Wolve	98.6	71	23.4	2.8	23	22	25
York	100.0	21	27.3	2.5	27	26	29

Table 9.19. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
N Ireland							
Antrim	46.2	6					
Belfast	100.0	15	24.7	3.0	25	23	27
Newry	100.0	14	26.6	4.2	27	26	29
Ulster	100.0	4					
West NI	90.9	10	25.9	3.3	26	26	27
Wales							
Bangor	100.0	15	27.3	2.9	27	25	29
Cardff	98.6	71	26.4	3.7	27	24	29
Clwyd	81.8	9					
Swanse	98.0	49	28.7	2.6	28	27	30
Wrexm	100.0	23	26.0	3.1	27	23	28
England	**87.4**	**2,387**	**25.3**	**3.4**	**25**	**23**	**28**
N Ireland	**86.0**	**49**	**25.4**	**3.4**	**26**	**23**	**27**
Wales	**97.7**	**167**	**27.0**	**3.4**	**27**	**25**	**29**
E, W & NI	**87.9**	**2,603**	**25.4**	**3.4**	**25**	**23**	**28**

Blank cells: low patient numbers or poor data completeness
*No PD patients

Table 9.20. Percentage of peritoneal dialysis patients within, below and above the range for bicarbonate (22–30 mmol/L) by centre in 2014

Centre	*N*	% bicarb 22–30 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <22 mmol/L	% bicarb >30 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
England									
B Heart	31	77.4	59.6	88.8	22.6	0.0	18.6	−3.5	40.7
B QEH	104	87.5	79.7	92.6	11.5	1.0	12.1	2.2	22.0
Basldn	22	81.8	60.4	93.0	0.0	18.2	−9.9	−29.4	9.7
Bradfd	16	93.8	66.5	99.1	6.3	0.0	−2.3	−16.4	11.9
Brightn	55	83.6	71.4	91.3	16.4	0.0	7.9	−6.3	22.1
Bristol	55	65.5	52.1	76.8	34.6	0.0	−7.8	−24.9	9.3
Camb	24	45.8	27.5	65.4	4.2	50.0	−36.5	−63.5	−9.6
Carlis	24	87.5	67.6	95.9	8.3	4.2	9.2	−12.2	30.7
Chelms	18	88.9	64.8	97.2	11.1	0.0	−0.6	−20.6	19.5
Covnt	75	90.7	81.7	95.5	5.3	4.0	−1.3	−10.7	8.2
Derby	70	82.9	72.2	90.0	17.1	0.0	−6.3	−17.6	5.0
Donc	24	83.3	63.1	93.6	12.5	4.2	0.0	−20.0	20.0
Dorset	46	63.0	48.4	75.6	32.6	4.4	−5.5	−26.3	15.2
Dudley	48	79.2	65.4	88.4	10.4	10.4	11.8	−6.0	29.5
Exeter	83	88.0	79.0	93.4	7.2	4.8	2.2	−8.9	13.4
Glouc	37	94.6	80.8	98.6	2.7	2.7	7.5	−6.4	21.4
Hull	65	86.2	75.5	92.6	7.7	6.2	2.8	−9.2	14.8
Ipswi	30	76.7	58.5	88.5	3.3	20.0	−15.0	−33.7	3.7
Kent	58	84.5	72.8	91.7	12.1	3.5	17.8	2.4	33.2
L Barts	195	77.4	71.0	82.8	21.5	1.0	16.3	7.0	25.6
L Guys	20	65.0	42.6	82.3	25.0	10.0	2.5	−26.0	31.0
L Kings	79	97.5	90.4	99.4	2.5	0.0	6.4	−0.8	13.7
L Rfree	99	83.8	75.2	89.9	13.1	3.0	3.6	−7.7	14.9
L St.G	45	86.7	73.4	93.9	0.0	13.3	8.9	−6.8	24.6
L West	44	72.7	57.9	83.8	27.3	0.0	−0.3	−18.2	17.5
Leeds	49	81.6	68.3	90.2	2.0	16.3	−8.7	−21.8	4.4
Leic	100	84.0	75.5	90.0	10.0	6.0	6.2	−4.0	16.4
Liv Ain	35	88.6	73.2	95.6	8.6	2.9	−7.6	−20.5	5.3
Liv Roy	49	91.8	80.2	96.9	8.2	0.0	−2.3	−12.3	7.7
M RI	61	83.6	72.1	91.0	16.4	0.0	−1.2	−13.9	11.5

Table 9.20. Continued

Centre	*N*	% bicarb 22–30 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <22 mmol/L	% bicarb >30 mmol/L	Change in % within range from 2013	95% LCL change	95% UCL change
Middlbr	13	84.6	54.9	96.1	15.4	0.0	2.8	−27.3	32.9
Newc	42	81.0	66.3	90.2	19.1	0.0	−0.3	−18.3	17.7
Norwch	30	40.0	24.3	58.1	60.0	0.0	−50.9	−71.0	−30.8
Nottm	46	78.3	64.1	87.9	2.2	19.6	−1.1	−19.2	16.9
Oxford	67	77.6	66.1	86.0	13.4	9.0	−10.5	−23.1	2.2
Plymth	31	87.1	70.3	95.1	12.9	0.0	20.4	−0.9	41.8
Ports	59	83.1	71.3	90.6	5.1	11.9	2.0	−11.1	15.1
Prestn	46	76.1	61.8	86.2	8.7	15.2	−6.6	−22.7	9.5
Redng	62	80.7	68.9	88.7	3.2	16.1	2.2	−11.8	16.2
Sheff	52	76.9	63.6	86.4	21.2	1.9	1.5	−14.2	17.3
Shrew	25	92.0	73.1	98.0	4.0	4.0	7.4	−10.1	24.9
Stevng	24	91.7	72.1	97.9	4.2	4.2	9.9	−7.3	27.0
Sthend	16	93.8	66.5	99.1	6.3	0.0	20.4	−4.9	45.7
Stoke	72	83.3	72.9	90.3	5.6	11.1	−4.2	−15.4	7.1
Sund	14	85.7	57.3	96.4	14.3	0.0			
Truro	16	87.5	61.4	96.9	0.0	12.5	16.9	−10.1	44.0
Wirral	15	73.3	46.7	89.6	0.0	26.7	−1.7	−31.0	27.7
Wolve	71	76.1	64.8	84.6	23.9	0.0	26.7	11.8	41.7
York	21	90.5	68.9	97.6	0.0	9.5	−1.5	−18.0	14.9
N Ireland									
Belfast	15	86.7	59.5	96.6	13.3	0.0	13.6	−10.6	37.8
Newry	14	85.7	57.3	96.4	7.1	7.1	3.4	−22.4	29.1
West NI	10	80.0	45.9	95.0	20.0	0.0	−4.6	−36.2	27.0
Wales									
Bangor	15	80.0	53.0	93.4	0.0	20.0	−3.3	−32.6	25.9
Cardff	71	80.3	69.4	88.0	8.5	11.3	−2.8	−15.8	10.2
Swanse	49	79.6	66.1	88.7	0.0	20.4	−11.0	−24.7	2.8
Wrexm	23	82.6	61.8	93.3	13.0	4.4	3.7	−20.3	27.7
England	**2,387**	**81.8**	**80.2**	**83.3**	**12.7**	**5.5**	**3.3**	**1.0**	**5.5**
N Ireland	**49**	**85.7**	**72.9**	**93.0**	**12.2**	**2.0**	**7.1**	**−6.6**	**20.9**
Wales	**167**	**80.8**	**74.2**	**86.1**	**6.0**	**13.2**	**−4.3**	**−12.4**	**3.7**
E, W & NI	**2,603**	**81.8**	**80.3**	**83.2**	**12.3**	**6.0**	**2.9**	**0.8**	**5.0**

Blank cells: no data available for 2013

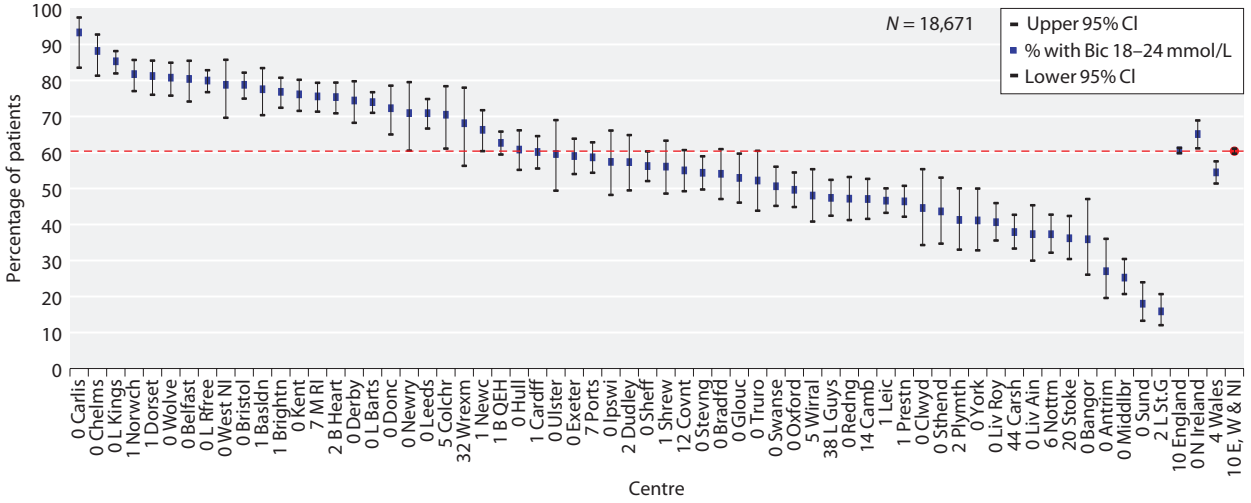

Fig. 9.20. Percentage of haemodialysis patients with serum bicarbonate within range (18–24 mmol/L) by centre in 2014

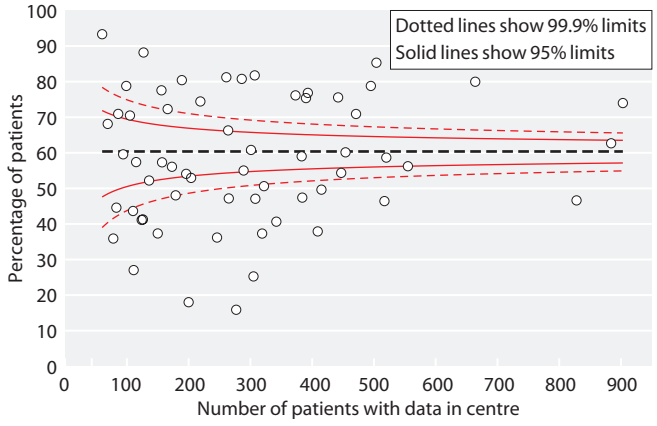

Fig. 9.21. Funnel plot for percentage of haemodialysis patients within the range for bicarbonate (18–24 mmol/L) by centre in 2014

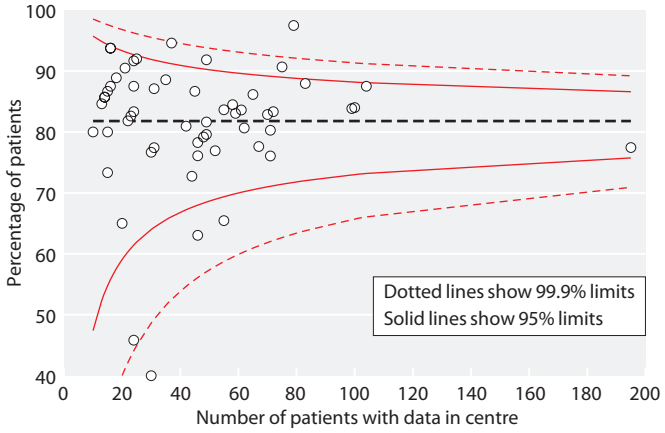

Fig. 9.23. Funnel plot for percentage of peritoneal dialysis patients within the range for bicarbonate (22–30 mmol/L) by centre in 2014

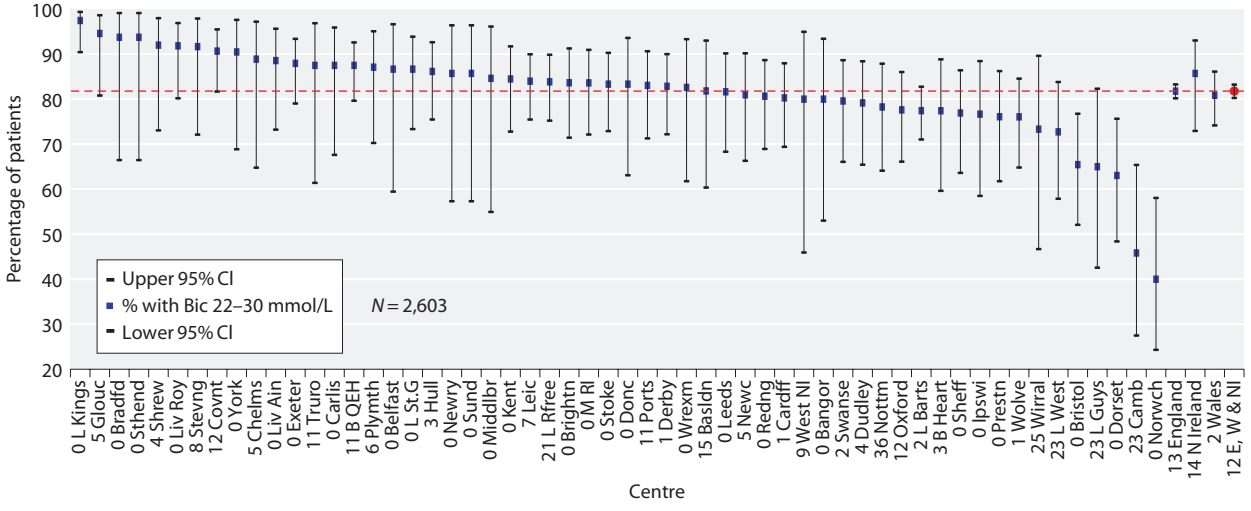

Fig. 9.22. Percentage of peritoneal dialysis patients with serum bicarbonate within range (22–30 mmol/L) by centre in 2014

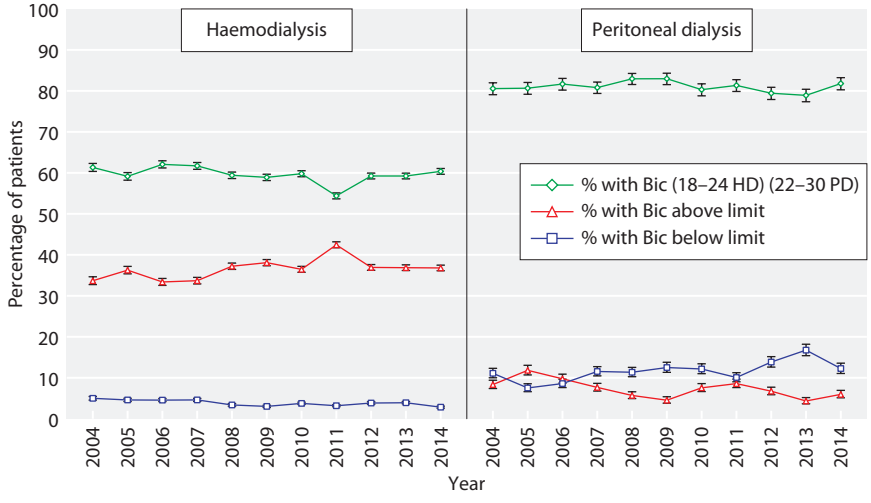

Fig. 9.24. Longitudinal change in percentage of patients within, below and above range for bicarbonate by dialysis modality 2004–2014

There has been a consistent difference between the modalities in the percentage with raised bicarbonate measures.

Conclusions

In summary, serum bicarbonate levels have not changed significantly, but it was observed that a persistent fraction of HD patients remained with raised bicarbonate levels. The UKRR has previously conducted a limited survey [9] into the possible underlying causes of serum bicarbonate variation. The study examined measures of sample processing and of dialysis treatment. It did not adjust for case-mix and was unable to detect any significant differences between centres. Studies have identified an increased risk of death stratified by a reduced pre dialysis serum bicarbonate level (<17 mmol/L) or with raised levels (>27 mmol/L) [10–13], as well as with raised dialysate bicarbonate concentrates [13]. Future analysis of management of acidosis will have to re-explore the factors associated with an increased trend in developing alkalosis in HD patients.

Analyses within this chapter present the ongoing improvement in achieving measures of bone and mineral disease management (BMD) in ESRF patients in the UK. In order to optimise BMD control further, it is necessary to explore confounding factors and applying adjustments to a number of case mix factors. These considerations can only be applied once the UKRR has access to an enhanced dataset from each centre. Many centres are updating their own IT systems, with an ambition that all new developments will comply with the National Renal Dataset. Thus, in future analyses, it may be possible to integrate details of assays used for the biochemical parameters, the local reference ranges adhered to, the dialysis dose and dialysate concentrations prescribed, as well as accessing all details of phosphate binder, calcium mimetic and vitamin D analogue use.

A number of studies have demonstrated reduced patient survival with disordered calcium and phosphate levels in dialysis patients [14–15] as well as with inadequate simultaneous control of three BMD parameters [13, 16, 17].

The UKRR 17th Annual Report chapter 8 [18] discussed the problems related to variations in calcium and PTH measurements. The inter and intra centre variation in the control of BMD parameters remains a challenge. So far, it has not been possible to perform analyses to examine these variations as the UKRR is faced with confounding factors, such as the completeness of data returns, as well as the differing assays used for PTH and albumin estimation.

Conflicts of interest: the authors declare no conflict of interest

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